

19960025309; 96N27381 Lawrence Livermore National Lab., Livermore, CA USA

Multilayer coatings for the EUVL front-end test bed

Vernon, S. P., Lawrence Livermore National Lab., USA; Carey, M. J., Lawrence Livermore National Lab., USA; Gaines, D. P., Lawrence Livermore National Lab., USA; Weber, F. J., Lawrence Livermore National Lab., USA; Jan. 19, 1995, pp. 15; In English; Optical Society of America Conference on Extreme Ultraviolet Lithography, 19-21 Sep. 1994, Monterey, CA, USA

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): UCRL-JC-119623; CONF-9409177-19; DE96-004320; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Good illumination uniformity at the mask and wafer planes, and high wafer throughput in the EUVL front-end test bed facility at LLNL require graded period multilayer (ML) coatings on several of the optics. The ML deposition was accomplished using a newly developed deposition technique which avoids the use of (open quotes)uniformity masks(close quotes) to define the spatial dependence of the ML period variation. The capabilities of the process in providing the specified ML coatings are discussed for both EUVL condenser and imaging systems.

DOE

Illuminance; Coatings; Deposition; Molybdenum; Masks; Wafers

19960025324; 96N27395 Maryland Univ., Dept. of Electrical Engineering., College Park, MD USA

Active Optical Filters for Spectral Processing (AAS-ERT) Final Report, 1 Jun. 1992 - 31 May 1995

Dagenais, Mario, Maryland Univ., USA; May 31, 1995, pp. 7; In English

Contract(s)/Grant(s): F49620-92-J-0258; AF Proj. 3484

Report No.(s): AD-A301964; AFOSR-TR-95-0758; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The work on the last year of this ASERP grant focused on three topics: Passive alignment of a semiconductor laser array to single mode optical fibers; Etched v-grooves in GaAs wafers; Alignment tolerant structures.

DTIC

Laser Arrays; Semiconductor Lasers; Optical Filters; Alignment; Gallium Arsenides; Optical Fibers

19960025431; 96N27468 Alabama Univ., Dept. of Electrical and Computer Engineering., Huntsville, AL USA

Optical amplifiers for coherent lidar

Fork, Richard, Alabama Univ., USA; Research Reports: 1995 NASA/ASEE Summer Faculty Fellowship Program; Feb. 1996, pp. 12; In English; Also announced as 1996043981; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

We examine application of optical amplification to coherent lidar for the case of a weak return signal (a number

of quanta of the return optical field close to unity). We consider the option that has been explored to date, namely, incorporation of an optical amplifier operated in a linear manner located after reception of the signal and immediately prior to heterodyning and photodetection. We also consider alternative strategies where the coherent interaction, the nonlinear processes, and the amplification are not necessarily constrained to occur in the manner investigated to date. We include the complications that occur because of mechanisms that occur at the level of a few, or one, quantum excitation. Two factors combine in the work to date that limit the value of the approach. These are: (1) the weak signal tends to require operation of the amplifier in the linear regime where the important advantages of nonlinear optical processing are not accessed, (2) the linear optical amplifier has a -3dB noise figure (SN(out)/SN(in)) that necessarily degrades the signal. Some improvement is gained because the gain provided by the optical amplifier can be used to overcome losses in the heterodyned process and photodetection. The result, however, is that introduction of an optical amplifier in a well optimized coherent lidar system results in, at best, a modest improvement in signal to noise. Some improvement may also be realized on incorporating more optical components in a coherent lidar system for purely practical reasons. For example, more compact, lighter weight, components, more robust alignment, or more rapid processing may be gained. We further find that there remain a number of potentially valuable, but unexplored options offered both by the rapidly expanding base of optical technology and the recent investigation of novel nonlinear coherent interference phenomena occurring at the single quantum excitation level. Key findings are: (1) insertion of linear optical amplifiers in well optimized conventional lidar systems offers modest improvements, at best, (2) the practical advantages of optical amplifiers, especially fiber amplifiers, such as ease of alignment, compactness, efficiency, light-weight, etc., warrant further investigation for coherent lidar, (3) the possibility of more fully optical lidar systems should be explored, (4) advantages gained by use of coherent interference of optical fields at the level of one, or a few, signal quanta should be explored, (5) amplification without inversion, population trapping, and use of electromagnetic induced transparency warrant investigation in connection with coherent lidar, (6) these new findings are probably more applicable to earth related NASA work, although applications to deep space should not be excluded, and (7) our own work in the Ultrafast Laboratory at UAH along some of the above lines of investigation, may be useful.

Author

Optical Radar; NASA Programs; University Program; Signal Processing; Coherent Radar; Linear Amplifiers

19960025448; 96N27485 Northwest Shoals Community Coll., Dept. of Electro-Optics., Phil Campbell, AL USA
SXI mirror characterization

Howard, Thomas G., Northwest Shoals Community Coll., USA; Research Reports: 1995 NASA/ASEE Summer Faculty Fellowship Program; Feb. 1996, pp. 6; In English; Also announced as 1996043981; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A test to determine how well the SXI (Solar X-ray Imager) mirror will focus x-ray energy from the Sun is reported.

Derived from text

Solar X-Rays; Grazing Incidence Telescopes; X Ray Astronomy; X Ray Telescopes; Spaceborne Telescopes; Grazing Incidence; Performance Tests; University Program; NASA Programs; X Ray Imagery

19960025460; 96N27497 Marquette Univ., Dept. of Physics., Milwaukee, WI USA

Linearization of an annular image by using a diffractive optic

Matthys, Donald R., Marquette Univ., USA; Research Reports: 1995 NASA/ASEE Summer Faculty Fellowship Program; Feb. 1996, pp. 8; In English; Also announced as 1996043981; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The goal for this project is to develop the algorithms for fracturing the zones defined by the mapping transformation, and to actually produce the binary optic in an appropriate setup. In 1984 a side-viewing panoramic viewing system was patented, consisting of a single piece of glass with spherical surfaces which produces a 360 degree view of the region surrounding the lens which extends about 25 degrees in front of and 20 degrees behind the lens. The system not only produces images of good quality, it is also afocal, i.e., images stay in focus for objects located right next to the lens as well as those located far from the lens. The lens produced a panoramic view in an annular shaped image, and so the lens was called a PAL (panoramic annular lens). When applying traditional measurements to PAL images, it is found advantageous to linearize the annular image. This can easily be done with a computer and such a linearized image can be produced within about 40 seconds on current microcomputers. However, this process requires a frame-grabber and a computer, and is not real-time. Therefore, it was decided to try to perform this linearization optically by using a diffractive optic.

Derived from text

Image Processing; Lenses; Algorithms; Diffractive Optics

19960025541; 96N27548 Sandia National Labs., Albuquerque, NM USA

Smooth, low-damage, definition of InGaAlAs asymmetric Fabry-Perot optical transmission modulators by Cl₂+Ar reactive-ion-beam etching

Vawter, G. A., Sandia National Labs., USA; Fritz, I. J., Sandia National Labs., USA; Drummond, T. J., Sandia National Labs., USA; Lee, S. R., Sandia National Labs., USA; Hafich,

M. J., Sandia National Labs., USA; Howard, A. J., Sandia National Labs., USA; Briggs, R. D., Sandia National Labs., USA; Casalnuovo, S. A., Sandia National Labs., USA; Griego, L., Sandia National Labs., USA; 1996, pp. 7; In English; 40th; International Conference on Electron, Ion and Photon Beam Technology and Nanofabrication, 28-31 May 1996, Atlanta, GA, USA

Contract(s)/Grant(s): AC04-94AL85000

Report No.(s): SAND-96-0289C; CONF-960582-1; DE96-007342; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Chlorine-argon-based reactive-ion-beam etching was used successfully to etch novel InGaAlAs (1.32 micrometer-wavelength Fabry-Perot resonator transmission) modulators. Resulting etch is very smooth, anisotropic, and has low etch-induced (sidewall) damage. Use of this simple chemistry eliminates difficulties with polymer formation encountered in hydrocarbon-based etches.

DOE

Aluminum Arsenides; Etching; Fabry-Perot Interferometers; Light Transmission; Gallium Arsenides; Anisotropy

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see 46 Geophysics. For space plasmas see 90 Astrophysics.

19960024100; 96N26671 National Inst. for Fusion Science, Nagoya, Japan

Measurement of neutron energy on D-T fusion plasma experiments

Osakabe, Masaki, National Inst. for Fusion Science, Japan; Apr. 1995, pp. 109; In English

Report No.(s): NIFS-347; DE96-708658; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The D-T fusion plasma experiments have been performed since November 1993 on TFTR. Tritium was introduced to the torus by gas puffing and/or by neutral beam injection (NBI). As auxiliary heatings, the NBI heating and ion cyclotron range of frequency (ICRF) heating were provided. The D-T neutron energy spectra were obtained for 'NBI and ICRF' heated plasmas and for NBI heated plasmas. These were the first D-T neutron spectra obtained from D-T plasmas in the world. The full width at half maximum (FWHM) of the peak for the ICRF heated plasma is wider than that for NBI heated plasma. The calculated energy spectra suggested this broadening was due to the existence of the high energy tritium ion tail of 100-400keV. Space resolved measurements of D-T neutron energy spectra will be necessary for ICRF heated D-T plasma experiments on the next large tokamak, such as ITER, to evaluate the mechanism of ICRF heat-

ing in the plasma. The counter telescope with thick radiator (COTETRA) will be a suitable diagnostic for this purpose because of its good energy resolution and compactness.

DOE

Beam Injection; Energy Spectra; Ion Cyclotron Radiation; Neutron Spectra; Plasma Heating; Plasmas (Physics); Tokamak Devices

19960024101; 96N26672 Japan Atomic Energy Research Inst., Tokyo, Japan

Convertible shielding to ceramic breeding blanket

Furuya, Kazuyuki, Japan Atomic Energy Research Inst., Japan; Kurasawa, Toshimasa, Japan Atomic Energy Research Inst., Japan; Sato, Satoshi, Japan Atomic Energy Research Inst., Japan; Nakahira, Masataka, Japan Atomic Energy Research Inst., Japan; Togami, Ikumide, Japan Atomic Energy Research Inst., Japan; Hashimoto, Toshiyuki, Japan Atomic Energy Research Inst., Japan; Takatsu, Hideyuki, Japan Atomic Energy Research Inst., Japan; Kuroda, Toshimasa, Japan Atomic Energy Research Inst., Japan; May 1995, pp. 27; In English

Report No.(s): JAERI-Tech-95-031; DE96-708580; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Four concepts have been studied for the ITER convertible blanket: (1) Layered concept;(2) BIT(Breeder-Inside-Tube)concept;(3) BOT(Breeder-Out of-Tube)concept; and (4) BOT/mixed concept. All concepts use ceramic breeder and beryllium neutron multiplier, both in the shape of small spherical pebbles, 316SS structure, and H₂O coolant (inlet/outlet temperatures : 100/150 C, pressure : 2 MPa). During the BPP, only beryllium pebbles (the primary pebble in case of BOT/mixed concept) are filled in the blanket for shielding purpose. Then, before the EPP operation, breeder pebbles will be additionally inserted into the blanket. Among possible conversion methods, wet method by liquid flow seems expecting for high and homogeneous pebble packing. Preliminary 1-D neutronics calculation shows that the BOT/mixed concept has the highest breeding and shielding performance. However, final selection should be done by R and D's and more detail investigation on blanket characteristics and fabricability. Required R and D's are also listed. With these efforts, the convertible blanket can be developed. However, the following should be noted. Though many of above R and D's are also necessary even for non-convertible blanket, R and D's on convertibility will be one of the most difficult parts and need significant efforts. Besides the installation of convertible blanket with required structures and lines for conversion will make the ITER basic machine more complicated.

DOE

Beryllium; Thermonuclear Reactions; Fusion Reactors; Shielding; Liquid Flow; Ceramics; Neutrons

19960024103; 96N26674 Japan Atomic Energy Research Inst., Tokyo, Japan

Fabrication and high heat flux test of divertor cooling elements

Suzuki, Satoshi, Japan Atomic Energy Research Inst., Japan; Araki, Masanori, Japan Atomic Energy Research Inst., Japan; Nakamura, Kazuyuki, Japan Atomic Energy Research Inst., Japan; Satoh, Kazuyoshi, Japan Atomic Energy Research Inst., Japan; Yokoyama, Kenji, Japan Atomic Energy Research Inst., Japan; Dairaku, Masayuki, Japan Atomic Energy Research Inst., Japan; Akiba, Masato, Japan Atomic Energy Research Inst., Japan; Jun. 1995, pp. 71; In English Report No.(s): JAERI-Tech-95-033; DE96-701318; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The plasma facing components in ITER are subjected to a high heat flux from fusion plasma. The heat flux is not only higher than that of existing tokamaks but also has a longer pulse duration (burn time). to minimize a peaking of the heat flux, the thermal deformation towards the plasma should be restrained. One-meter-long monoblock divertor modules with a sliding support structure were fabricated and tested at JAERI. Two kinds of support mechanisms were provided to minimize the thermal deformation of the modules in the upward and downward directions ; one is a pin type sliding structure and the other is a rail type support structure. Both modules were tested on the electron beam HHF test facility, JEBIS (JAERI Electron Beam Irradiation System), in JAERI. The steady-state heat flux of 15 MW/m² was applied to the surface of the modules to simulate the design condition of ITER CDA. As a result of the HHF test, the performance of the sliding support structures was successfully demonstrated. Three dimensional elastic stress analyses were conducted using a finite element method. The result shows that the relatively high thermal stress is observed at the cooling tube ; and that the maximum thermal stress at the cooling tube exceeds its yield strength. It is necessary to perform the lifetime evaluation of the copper cooling tube against cyclic thermal stresses.

DOE

Computerized Simulation; Heat Flux; Diverters; Stress Analysis; Thermonuclear Reactions; Tokamak Devices; Finite Element Method; Thermal Stresses; Plasmas (Physics)

19960024118; 96N26687 Oak Ridge National Lab., TN USA

Design of the ICRH antenna for TPX

Fogelman, C. H., Oak Ridge National Lab., USA; Goranson, P. L., Oak Ridge National Lab., USA; Swain, D. W., Oak Ridge National Lab., USA; Ryan, P. M., Oak Ridge National Lab., USA; Yugo, J. J., Oak Ridge National Lab., USA; 1996, pp. 8; In English; 16th; Sofe 1995: IEEE/NPSS Symposium on Fusion Engineering, 30 Sep. - 4 Oct. 1995, Champaign, IL, USA

Contract(s)/Grant(s): DE-AC05-84OR-21400

Report No.(s): CONF-950905-19; DE96-004266; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A 6-MW ion cyclotron (IC) system for the Tokamak Physics Experiment (TPX) is in the preliminary design phase. In conjunction with the 3-MW Lower Hybrid system and the 8-MW neutral beam system, the IC system will provide heating and current-drive capabilities to explore advanced tokamak physics and long-pulse (1000 s) operation. The IC launcher consists of six nickel-plated current straps arranged toroidally in pairs behind three water-cooled Faraday shields. The Faraday shields can be independently mid remotely detached by cutting water lines at the back of the launcher and removing bolts at the front to free each shield. The antenna can be located at the +2 cm flux line and retracted 10 cm. Faraday shields are usually copper- or nickel-plated stainless steel or inconel. Titanium is the preferred material to minimize activation without greatly decreasing electrical resistivity and therefore increasing disruption loads. The IC antenna research and development programs have provided data that confirm the feasibility of B(sub 4)C-coated nickel-plated titanium alloy in the TPX environment.

DOE

Tokamak Devices; Ion Cyclotron Radiation; Resistance Heating; Antenna Design

19960024135; 96N26701 Japan Atomic Energy Research Inst., Tokyo, Japan

Evaluation of divertor and scrape-off plasma parameters using simple two point model

Nagashima, Keisuke, Japan Atomic Energy Research Inst., Japan; Jul. 1995, pp. 23; In English

Report No.(s): JAERI-Research-95-052; DE96-708713; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A simple two point model was developed in order to evaluate divertor and scrape-off plasma parameters. The advantage of this model is a capability for evaluating not only the plasma parameters but also the neutral parameters, like the recycling rate and the particle multiplication factor, without detailed numerical simulations. This model was applied to JT-60 Super Upgrade for determining the guideline values of the divertor design. It was found that the particle pumping rate (the pumped flux over the total flux to the divertor plates) should be about 0.5% and the rate of back-flow neutral flux should be under 2%, in order to obtain enough He-ash exhaust and cold-dense divertor plasma in the steady state operation.

DOE

Plasmas (Physics); Dense Plasmas; Ashes; Cold Plasmas

19960024160; 96N26721 National Inst. for Fusion Science, Nagoya, Japan

Dynamic structure in self-sustained turbulence

Itoh, K., National Inst. for Fusion Science, Japan; Itoh, S., National Inst. for Fusion Science, Japan; Yagi, M., National Inst. for Fusion Science, Japan; Fukuyama, A., National Inst.

for Fusion Science, Japan; Jun. 1995, pp. 57; In English
Report No.(s): NIFS-360; DE96-708654; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Dynamical equation for the self-sustained and pressure-driven turbulence in toroidal plasmas is derived. The growth rate of the dressed-test mode, which belongs to the subcritical turbulence, is obtained as a function of the turbulent transport coefficient. In the limit of the low fluctuation level, the mode has the feature of the nonlinear instability and shows the explosive growth. The growth rate vanishes when the driven transport reaches to the stationarily-turbulent level. The stationary solution is thermodynamically stable. The characteristic time, by which the stationary and self-sustained turbulence is established, scales with the ion-sound transit time and is accelerated by the bad magnetic curvature. Influences of the pressure gradient as well as the radial electric field inhomogeneity are quantified.

DOE

Tokamak Devices; Transport Properties; Turbulence; Stability; Pressure Gradients; Electric Fields; Toroidal Plasmas

19960024171; 96N26730 Oak Ridge National Lab., TN USA

Development of pellet injection systems for ITER

Combs, S. K., Oak Ridge National Lab., USA; Gouge, M. J., Oak Ridge National Lab., USA; Baylor, L. R., Oak Ridge National Lab., USA; Foust, C. R., Oak Ridge National Lab., USA; Fisher, P. W., Oak Ridge National Lab., USA; Milora, S. L., Oak Ridge National Lab., USA; Qualls, A. L., Oak Ridge National Lab., USA; Schechter, D. E., Oak Ridge National Lab., USA; Walters, J. M., Oak Ridge National Lab., USA; 1995, pp. 11; In English; 16th; Sope 1995: IEEE/NPSS Symposium on Fusion Engineering, 30 Sep. - 4 Oct. 1995, Champaign, IL, USA

Contract(s)/Grant(s): DE-AC05-84OR-21400

Report No.(s): CONF-950905-20; DE96-004268; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Oak Ridge National Laboratory (ORNL) has been developing innovative pellet injection systems for plasma fueling experiments on magnetic fusion confinement devices for about 20 years. Recently, the ORNL development has focused on meeting the complex fueling needs of the InterNational Thermonuclear Experimental Reactor (ITER). In this paper, we describe the ongoing research and development activities that will lead to a ITER prototype pellet injector test stand. The present effort addresses three main areas: (1) an improved pellet feed and delivery system for centrifuge injectors, (2) a long-pulse (up to steady-state) hydrogen extruder system, and (3) tritium extruder technology. The final prototype system must be fully tritium compatible and will be used to demonstrate the operating parameters and the reliability required for the ITER fueling application.

DOE

Tokamak Devices; Pellets; Injection; Fusion Reactors; Thermonuclear Reactions; Nuclear Fusion; Nuclear Fuels

19960024197; 96N26748 Oak Ridge National Lab., TN USA

Disruptions, loads, and dynamic response of ITER

Nelson, B., Oak Ridge National Lab., USA; Riemer, B., Oak Ridge National Lab., USA; Sayer, R., Oak Ridge National Lab., USA; Strickler, D., Oak Ridge National Lab., USA; Barabaschi, P., InterNational Thermonuclear Experimental Reactor Joint Central Team, USA; Ioki, K., InterNational Thermonuclear Experimental Reactor Joint Central Team, USA; Johnson, G., InterNational Thermonuclear Experimental Reactor Joint Central Team, USA; Shimizu, K., InterNational Thermonuclear Experimental Reactor Joint Central Team, USA; Williamson, D., InterNational Thermonuclear Experimental Reactor Joint Central Team, USA; 1995, pp. 10; In English; 16th; SOFE 1995: IEEE/NPSS Symposium on Fusion Engineering, 30 Sep. - 4 Oct. 1995, Champaign, IL, USA

Contract(s)/Grant(s): DE-AC05-84OR-21400

Report No.(s): CONF-950905-17; DE96-004570; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Plasma disruptions and the resulting electromagnetic loads are critical to the design of the vacuum vessel and in-vessel components of the InterNational Thermonuclear Experimental Reactor (ITER). This paper describes the status of plasma disruption simulations and related analysis, including the dynamic response of the vacuum vessel and in-vessel components, stresses and deflections in the vacuum vessel, and reaction loads in the support structures.

DOE

Tokamak Devices; Fusion Reactors; Dynamic Response; Vacuum Systems; Computerized Simulation; Plasma-Electromagnetic Interaction; Stress Distribution; Deflection

19960024208; 96N26757 Lawrence Livermore National Lab., Livermore, CA USA

Recirculating induction accelerators for inertial fusion: Prospects and status

Friedman, A., Lawrence Livermore National Lab., USA; Barnard, J. J., Lawrence Livermore National Lab., USA; Cable, M. D., Lawrence Livermore National Lab., USA; Callahan, D. A., Lawrence Livermore National Lab., USA; Deadrick, F. J., Lawrence Livermore National Lab., USA; Eylon, S., Titan Beta, USA; Fessenden, T. J., California Univ., USA; Gote, D. P., Lawrence Livermore National Lab., USA; Hopkins, H. A., Lawrence Livermore National Lab., USA; Karpenko, V. P., Lawrence Livermore National Lab., USA; Judd, D. L., California Univ., USA; Kirbie, H. C., Lawrence Livermore National Lab., USA; Longinotti, D. B., EG and G Energy Measurements, Inc., USA; Lund, S. M., Lawrence Livermore National Lab., USA; Nattrass, L. A., Lawrence Livermore National Lab., USA; Nelson, M. B., Lawrence Livermore

National Lab., USA; Newton, M. A., Lawrence Livermore National Lab., USA; Sangster, T. C., Lawrence Livermore National Lab., USA; Sharp, W. M., Lawrence Livermore National Lab., USA; Sep. 03, 1995, pp. 32; In English; International Symposium on Heavy Ion Inertial Fusion, 6-9 Sep. 1995, Princeton, NJ, USA

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): UCRL-JC-121455; CONF-9509149-11; DE96-003696; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The US is developing the physics and technology of induction accelerators for heavy-ion beam-driven inertial fusion. The recirculating induction accelerator repeatedly passes beams through the same set of accelerating and focusing elements, thereby reducing both the length and gradient of the accelerator structure. This promises an attractive driver cost, if the technical challenges associated with recirculation can be met. Point designs for recirculator drivers were developed in a multi-year study by LLNL, LBNL, and FM Technologies, and that work is briefly reviewed here. To validate major elements of the recirculator concept, we are developing a small (4-5-m diameter) prototype recirculator which will accelerate a space-charge-dominated beam of K(+) ions through 15 laps, from 80 to 320 keV and from 2 to 8 mA. Transverse beam confinement is effected via permanent-magnet quadrupoles; bending is via electric dipoles. This 'Small Recirculator' is being developed in a build-and-test sequence of experiments. An injector, matching section, and linear magnetic channel using seven half-lattice periods of permanent-magnet quadrupole lenses are operational. A prototype recirculator half-lattice period is being fabricated. This paper outlines the research program, and presents initial experimental results.

DOE

Inertial Confinement Fusion; Ion Accelerators; Heavy Ions; Ion Beams; Research; Beam Injection

19960024209; 96N26758 Japan Atomic Energy Research Inst., Dept. of Fusion Plasma Research., Tokai, Japan

Development of ion diagnostic system based on electrostatic probe in the boundary plasma of the JFT-2M tokamak

Uehara, Kazuya, Japan Atomic Energy Research Inst., Japan; Amemiya, Hiroshi, Institut fuer Plasmaphysik G.m.b.H., Germany; Hoethker, Klaus, Institut fuer Plasmaphysik G.m.b.H., Germany; Cosler, Arnold, Institut fuer Plasmaphysik G.m.b.H., Germany; Bieger, Wolfgang, Fachhochschule, Germany; Kawakami, Tomohide, Japan Atomic Energy Research Inst., Japan; Jun. 1995, pp. 84; In English

Report No.(s): JAERI-Research-95-040; DE96-708717; Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

An ion diagnostic system using electrostatic probes for measurements in the JFT-2M tokamak boundary plasma has

been developed under the collaboration program between KFA and JAERI. The rotating double probe system, on which the Hoethker double probe and Amemiya asymmetric probe can be mounted, are manufactured at KFA workshop while the linear driver to support the rotating double probe, the ion toothbrush probe, the Katsumata probe and the cubic Mach probe are developed at JAERI. This report describes the hardware of this probe system for ion diagnostics in the boundary plasma and preliminary data obtained by means of this system. Furthermore, results on the transport are estimated on the basis of these probe data.

DOE

Electrostatic Probes; Plasma Density; Plasma Physics; Boundary Layers; Ion Probes

19960024217; 96N26766 Oak Ridge National Lab., Metals and Ceramics Div., TN USA

Fracture toughness of irradiated candidate materials for ITER first wall/blanket structures

Alexander, David J., Oak Ridge National Lab., USA; Pawel, Janet E., Oak Ridge National Lab., USA; Grossbeck, Martin L., Oak Ridge National Lab., USA; Rowcliffe, Arthur F., Oak Ridge National Lab., USA; Shiba, Kiyoyuki, Japan Atomic Energy Research Inst., Japan; 1994, pp. 31; In English; 17th; Symposium on Effects of Radiation on Materials, 20-23 Jun. 1994, Sun Valley, ID, USA

Contract(s)/Grant(s): DE-AC05-84OR-21400

Report No.(s): CONF-940657-9; DE96-004387; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Disk compact specimens of candidate materials for first wall/blanket structures in ITER have been irradiated to damage levels of about 3 dpa at nominal irradiation temperatures of either 90 or 250 C. These specimens have been tested over a temperature range from 20 to 250 C to determine J-integral values and tearing moduli. The results show that irradiation at these temperatures reduces the fracture toughness of austenitic stainless steels, but the toughness remains quite high. The toughness decreases as the test temperature increases. Irradiation at 250 C is more damaging than at 90 C, causing larger decreases in the fracture toughness. Ferritic-martensitic steels are embrittled by the irradiation, and show the lowest toughness at room temperature.

DOE

Fracture Strength; Irradiation; Austenitic Stainless Steels; Temperature Effects; J Integral; Blankets (Fusion Reactors); Reactor Materials; Tokamak Devices

19960024252; 96N26787 Oak Ridge National Lab., TN USA

Discharges with high bootstrap current fraction on Tore Supra

Joffrin, E., Association Euratom-CEA, France; Saoutic, B., Association Euratom-CEA, France; Basiuk, V., Association Euratom-CEA, France; Forest, C., General Atomics Co.,

USA; Houlberg, W.A., Oak Ridge National Lab., USA; Hunter, T., Association Euratom-CEA, France; Kessel, C. E., Princeton Univ., USA; Litaudon, X., Association Euratom-CEA, France; 1995, pp. 3; In English; EC Project In Fusion Plasma (TORE SUPRA) #195 Collaborative, 5 Jun. - 14 Jul. 1995, Cadarache, France; Limited Reproducibility. More than 20% of this document may be affected by microfiche quality.

Contract(s)/Grant(s): DE-AC05-84OR-21400

Report No.(s): CONF-9506305-1; DE96-004933; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

Bootstrap current is regarded as a serious candidate for non-inductively driving a significant fraction of the total current. High bootstrap fraction discharges have already been achieved and analysed in several tokamaks, including JT-60, D3-D and TFTR. Tore Supra (R=2.36 m, a=0.80 m) is particularly suited for the study of non-inductive discharges and long pulse operation. It is equipped with several of non-inductive current drive/heating systems including Lower Hybrid Current Drive (LHCD), Fast Wave Electron Heating (FWEH), and in the future Electron Cyclotron Heating. Fully non-inductive discharges with enhanced confinement (LHEP mode) have already been obtained in Tore Supra with LHCD. High (Beta)_p ((1e)1.6) regimes current have also been achieved in the presence of FWEH. In particular, a discharge with 70% of the total current generated by the bootstrap current was observed. In this context, non-inductive current density profile determination is essential for understanding current drive experiments and ultimately for implementing current profile control. This paper briefly describes two methods developed on Tore Supra to determine the non-inductive current density profiles. The agreement between the two methods has been tested by applying them to ohmic discharges. These methods are then applied to the high bootstrap fraction discharges heated by FWEH. The non-inductive current density profile of these discharges are carried out, and the results are finally compared to several models of bootstrap current including Hirsman's with low collisionality, matrix formulation and both Kessel and Houlberg matrix formulation.

DOE

Current Density; Tokamak Devices; Plasma Heating

19960024321; 96N26838 Japan Atomic Energy Research Inst., Tokyo, Japan

Review of cold fusion

Mar. 1995, pp. 104; In Japanese

Report No.(s): JAERI-Review-95-003; DE95-789285; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This review describes the results from the following works: (1) to overview the chronological history of 'cold fusion' including the InterNational Conferences on cold fusion (ICCF-3 and ICCF-4); (2) to overview the various

theories which can explain the 'cold fusion' phenomena; (3) to overview the current status of the experiments to produce anomalous excess heat by electrolysis with palladium electrodes; (4) to explain the excess heat phenomena on the basis of chemical heat in hydrogen dissolution to palladium alloys; (5) to check the possibility of multi-body fusion reactions in hydrogen-absorbed palladium alloys; and (6) to overview newly-proposed ideas to realize nuclear fusion in smaller devices than the magnetic or laser fusion devices. JAERI presented a view that 'cold fusion' using electrolysis with palladium electrodes seemed to show no evidence of nuclear fusion, in the journal of 'Genshiryoku-Kogyo (in Japanese)'. As a result from this review, JAERI confirms to reach almost the same conclusion as the previously-stated view, while the ideas or experiments to achieve nuclear fusion without contradiction against the knowledge of physics and using small-scale devices should be encouraged.

DOE

Nuclear Fusion; Palladium Alloys; Laser Fusion; Electrolysis

19960024340; 96N26855 Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H., Vienna, Austria

Numeric simulation of non linear processes in plasma *Numerische Simulation nichtlinearer Prozesse in Plasmen*

Kamelander, G., Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H., Austria; Sdouz, G., Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H., Austria; Weimann, G., Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H., Austria; Demchenko, V., Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H., Austria; Jul. 1995, pp. 51; In German

Report No.(s): OEFZS-4751; DE96-610382; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

This report gives an overview on the theory of parametric instabilities and their applications in plasma physics. The numerical studies have been performed by means of the VLA-SOV-code allowing for a self-consistent solution of the relativistic Vlasov-equation together with the Maxwell equations. The investigations have been focussed on the production of toroidal current by means of stimulated Raman scattering (SSR) in a tokamak. This current should be a supplement to the inductive current. by simulations it has been shown that in fact a considerable quantity of longitudinal current can be produced by the SSR-effect if the stochastic regime is reached. (author).

DOE

Plasmas (Physics); Maxwell Equation; Nonlinearity; Tokamak Devices; Computerized Simulation; Vlasov Equations; Magnetohydrodynamic Stability

19960024343; 96N26858 Ecole Polytechnique Federale de Lausanne, Centre de Recherche en Physique des Plasma., Switzerland

Spectrum of ballooning instabilities in a stellarator

Cooper, W. A., Ecole Polytechnique Federale de Lausanne, Switzerland; Singleton, David B., Australian National Univ., Australia; Dewar, Robert L., Australian National Univ., Australia; Aug. 1995, pp. 23; In English

Report No.(s): LRP-527/95; DE96-609053; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The recent revival of interest in the application of the 'ballooning formalism' to low-frequency plasma instabilities has prompted a comparison of the Wentzel-Brillouin-Kramers (WKB) ballooning approximation with an (in principle) exact normal mode calculation for a three-dimensional plasma equilibrium. Semiclassical quantization, using the ideal magnetohydrodynamic (MHD) ballooning eigenvalue to provide a local dispersion relation, is applied to a ten-field period stellarator test case. Excellent qualitative agreement, and good quantitative agreement is found with predictions from the TERPSICHORE code for toroidal mode numbers from 1 to 14 and radial mode numbers from 0 to 2. The continuum bands predicted from three-dimensional WKB theory are too narrow to resolve.

DOE

Ballooning Modes; Balloons; Wentzel-Kramer-Brillouin Method; Stellarators; Magnetohydrodynamic Stability

19960024344; 96N26859 Royal Inst. of Tech., Dept. of Fusion Plasma Physics., Stockholm, Sweden

On edge transport in pure Extrap discharges

Lehnert, Bo, Royal Inst. of Tech., Sweden; Mar. 1995, pp. 30; In English

Report No.(s): TRITA-ALF-1995-6; DE96-609048; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A simple theoretical model is presented of moderate-size experiments on the pure Extrap mode in which an octupole magnetic field is imposed on a Z-pinch. Plasma-neutral gas interaction is thereby found to constitute a major heat loss mechanism. In combination with the limitation of the pinch radius by a magnetic separatrix, this results in a limitation of achievable pinch currents and temperatures. Within the uncertainty of the approximations involved in the model, the deduced results seem to be consistent with so far performed experiments, in respect to the observed relations between the plasma density, the pinch current and temperature, and the power loss and energy confinement time. Nevertheless, additional losses by anomalous transport cannot be excluded. In the interpretation of experiments, care is further necessary in checking the excess current which may flow outside the separatrix. The high beta value of the pure Extrap mode is obtained at the expense of a limited pinch current and a comparatively poor heating, whereas screw pinches and reversed field

pinches provide stronger currents and heating, at the expense of a reduced beta value.

DOE

Zeta Pinch; Magnetic Fields; Plasma Interactions; Heat Transfer

19960024371; 96N26885 Japan Atomic Energy Research Inst., Tokyo, Japan

Feasibility study of first wall electrical connector

Kitamura, Kazunori, Japan Atomic Energy Research Inst., Japan; Takatsu, Hideyuki, Japan Atomic Energy Research Inst., Japan; Koizumi, Kouichi, Japan Atomic Energy Research Inst., Japan; Tsunematsu, Toshihide, Japan Atomic Energy Research Inst., Japan; May 1995, pp. 24; In English Report No.(s): JAERI-Tech-95-032; DE96-701317; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A feasibility study of first wall electrical connector concept has been performed to mitigate plasma disruption effect of electromagnetic force on the blanket structure. A multi-layered thin copper plate was applied to the connector structure, which was installed between adjacent first walls with keys and bolts. An optimization on the connector mechanical stiffness was performed to withstand the large electromagnetic forces at the plasma disruption and to absorb the module displacement between adjacent blanket structures due to thermal expansion of the modular blanket. As the results, a possible structural solution of the first wall electrical connector concept has been developed, which seems feasible in the views of mechanical integrity and fabricability, however, further detailed study on the connector feasibility is required.

DOE

Electric Connectors; Copper; Plasmas (Physics); Thin Plates; Mechanical Properties; Tokamak Devices; Walls

19960024751; 96N26916 China Nuclear Information Centre, Beijing, China

Stability analysis of tokamak resistive internal kink mode in ion kinetic regime

Shi, Bingren, Southwest Inst. of Physics, China; Sui, Guofang, Southwest Inst. of Physics, China; Guo, Gancheng, Southwest Inst. of Physics, China; Jun. 1995, pp. 20; In English

Report No.(s): CNIC-00963; SIP-0081; DE96-610381; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

Using the dispersion relation of tokamak internal kink mode in ion kinetic regime, the frequency and the growth rate as functions of $s(\text{sub } 0)$, the magnetic shear were analyzed. It was pointed that there is a critical shear $s(\text{sub } 0c)$, the resistive internal kink mode can only be excited when $s(\text{sub } 0)$ greater than $s(\text{sub } 0c)$, i.e., when $q(\text{sub } 0)$ less than $q(\text{sub } 0c)$ less than 1. On other hand, for large $s(\text{sub } 0)$ case, the growth rate of the resistive internal kink mode is several times of that obtained

from the MHD regime, which is consistent with the fast crash phenomena of saw-tooth.

DOE

Tokamak Devices; Electrical Resistivity; Plasma Waves; Wave Dispersion

19960024761; 96N26925 Lawrence Livermore National Lab., Livermore, CA USA

Chamber propagation physics for heavy ion fusion

Callahan, Debra A., Lawrence Livermore National Lab., USA; Sep. 01, 1995, pp. 27; In English; InterNational Symposium on Heavy Ion Inertial Fusion, 6-9 Sep. 1995, Princeton, NJ, USA

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): UCRL-JC-121279; CONF-9509149-15; DE96-005384; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Chamber transport is an important area of study for heavy ion fusion. Final focus and chamber-transport are high leverage areas providing opportunities to significantly decrease the cost of electricity from a heavy ion fusion power plant. Chamber transport in two basic regimes is under consideration. In the low chamber density regime (approx. less than 0.003 torr), ballistic or nearly-ballistic transport is used. Partial beam neutralization has been studied to offset the effects of beam stripping. In the high chamber density regime (approx. greater than 0.1 torr), two transport modes (pinched transport and channel transport) are under investigation. Both involve focusing the beam outside the chamber then transporting it at small radius (approx. 2 mm). Both high chamber density modes relax the constraints on the beam quality needed from the accelerator which will reduce the driver cost and the cost of electricity.

DOE

Heavy Ions; Beam Neutralization; Ion Beams; Transport Properties; Inertial Fusion (Reactor)

19960024762; 96N26926 General Atomics Co., San Diego, CA USA

Target support for inertial confinement fusion

Schultz, K. R., General Atomics Co., USA; Aug. 1995, pp. 11; In English; Fusion Power Associates Fusion Industry Stakeholders Conference, 14-15 Jun. 1995, Washington, DC, USA Contract(s)/Grant(s): DE-AC03-91SF-18601

Report No.(s): GA-A22107; CONF-9506135-1; DE96-005247; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

General Atomics (GA) plays an important industrial support role for the US Inertial Confinement Fusion (ICF) program in the area of target technology. This includes three major activities: target fabrication support, target handling systems development, and target chamber design. The work includes target fabrication for existing ICF experiments, target and target system development for future experiments,

and target research and target chamber design for experiments on future machines, such as the National Ignition Facility (NIF).

DOE

Inertial Confinement Fusion; Targets

19960024782; 96N26943 General Atomics Co., San Diego, CA USA

Designing a VH-mode core/L-mode edge discharge

Staebler, G. M., General Atomics Co., USA; Hinton, F. L., General Atomics Co., USA; Wiley, J.C., Texas Univ., USA; Dec. 1995, pp. 11; In English; Iaea Technical Committee Meeting/US-Japan Workshop on H-mode Physics, 18-20 Sep. 1995, Princeton, NJ, USA

Contract(s)/Grant(s): DE-AC03-89ER-51114

Report No.(s): GA-A22155; CONF-9509238-3; DE96-005248; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An operating mode with a very high confinement core like the VH-mode but a very low power flow to the divertor plates and low edge particle confinement like an L-mode would be beneficial. For a large tokamak like the proposed ITER, the power density at the separatrix is not that far above the scaled H-mode power threshold so not much of the power can be radiated inside of the separatrix without causing a return to L-mode. The thicker scrape-off layer of an L-mode increases the radiating volume of the scrape-off layer and helps shield impurities from the core. This is especially important if the first wall is metallic. In this paper an H-mode transport model based on $E \times B$ velocity shear suppression of turbulence will be used to show that it is possible to have a strongly radiating mantle near the separatrix, which keeps the edge in L-mode, while having a VH-mode core with a broad region of suppressed turbulence. The existing results of enhanced L-mode confinement during impurity injection on a number of tokamaks will be surveyed. The operating conditions which will most likely result in the further improvement of the core confinement by control of the heating, fueling, and torque profiles will be identified.

DOE

Tokamak Devices; Confinement; Fusion Reactors; Thermo-nuclear Reactions

19960024789; 96N26950 Wisconsin Univ., Dept. of Plasma Physics., Madison, WI USA

Lower hybrid accessibility in a large, hot reversed field pinch

Dziubek, R. A., Wisconsin Univ., USA; Harvey, R. W., General Atomics Co., USA; Hokin, S. A., Wisconsin Univ., USA; Uchimoto, E., Montana Univ., USA; Nov. 1995, pp. 38; In English

Contract(s)/Grant(s): DE-FG02-85ER-53212

Report No.(s): DOE/ER/53212-269; DE96-005637; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Accessibility and damping of the slow wave in a reversed field pinch (RFP) plasma is investigated theoretically, using projected Reversed Field Experiment (RFX) plasma parameters. By numerically solving the hot plasma dispersion relation, regions of propagation are found and the possibility of mode conversion is analyzed. If the parallel index of refraction of the wave is chosen judiciously at the edge of the plasma, the slow wave is accessible to a target region located just inside the reversal surface without mode conversion. Landau damping is also optimized in this region. A representative fast electron population is then added in order to determine its effect on accessibility and damping. The presence of these electrons, whose parameters were estimated by extrapolation of Madison Symmetric Torus (MST) data, does not affect the accessibility of the wave. However, the initial phase velocity of the wave needs to be increased somewhat in order to maintain optimal damping in the target zone.

DOE

High Temperature Plasmas; Plasma Waves; Wave Dispersion; Landau Damping; Electron Plasma; Plasma Diffusion

19960024791; 96N26951 Sandia National Labs., Beam, Plasma, and Electromagnetic Theory Dept., Albuquerque, NM USA

Index of light ion inertial confinement fusion. Publications and presentations January 1989 through December 1993

Sweeney, Mary Ann, Editor, Sandia National Labs., USA; Nov. 1995, pp. 183; In English

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-93-4042; DE96-005123; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This report lists publications and presentations that are related to inertial confinement fusion and were authored or co-authored by Sandians in the Pulsed Power Sciences Center from 1989 through 1993. The 661 publications and presentations are categorized into the following general topics: (1) reviews, (2) ion sources, (3) ion diodes, (4) plasma opening switches, (5) ion beam transport, (6) targets and deposition physics, (7) advanced driver and pulsed power technology development, (8) diagnostics, and (9) code development. Research in these areas is arranged by topic in chronological order, with the early efforts under each topic presented first. The work is also categorized alphabetically by first author. A list of acronyms, abbreviations, and definitions of use in understanding light ion inertial confinement fusion research is also included.

DOE

Data Acquisition; Information Retrieval; Inertial Confinement Fusion; Diodes

19960024876; 96N27015 Lawrence Livermore National Lab., Livermore, CA USA

Induced magnetic-field effects in inductively coupled plasmas

Cohen, Ronald H., Lawrence Livermore National Lab., USA; Rognlien, Thomas D., Lawrence Livermore National Lab., USA; Nov. 04, 1995, pp. 31; In English; 37th; Annual Meeting of the American Physical Society Division of Plasma Physics, 6-10 Nov. 1995, Louisville, KY, USA

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): UCRL-JC-121367; CONF-951182-9; DE96-005386; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In inductive plasma sources, the rapid spatial decay of the electric field arising from the skin effect produces a large radio frequency (RF) magnetic field via Faraday's law. We previously determined that this magnetic field leads to a reduction of the electron density in the skin region, as well as a reduction in the collisionless heating rate. The electron deficit leads to the formation of an electrostatic potential which pulls electrons in to restore quasineutrality. Here we calculate the electron density including both the induced and electrostatic fields. If the wave frequency is not too low, the ions respond only to the averaged fields, and hence the electrostatic field is oscillatory, predominantly at the second harmonic of the applied field. We calculate the potential required to establish a constant electron density, and compare with numerical orbit-code calculations. For times short compared to ion transit times, the quasineutral density is just the initial ion density. For timescales long enough that the ions can relax, the density profile can be found from the solution of fluid equations with an effective (ponderomotive-like) potential added. Although the time-varying electrostatic potential is an extra source of heating, the net effect of the induced magnetic and electrostatic fields through trapping, early turning, and direct heating is a significant reduction in collisionless heating for parameters of interest.

DOE

Electron Density (Concentration); Electromagnetic Fields; Ion Density (Concentration); Oscillations

19960024878; 96N27017 Sandia National Labs., Albuquerque, NM USA

Electroreflectance and the problem of studying plasma-surface interactions

Preppernau, Bryan L., Sandia National Labs., USA; 1995, pp. 10; In English; 7th; InterNational Symposium on Laser-aided Plasma Diagnostics, 5-8 Dec. 1995, Fukuoka, Japan

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-95-2875C; CONF-951264-1; DE96-004303; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A long standing problem in low-temperature plasma discharge physics is to understand in detail the mutual interaction

of real exposed surfaces (electrodes) with the reactive plasma environment. In particular, one wishes to discern the influence of these surfaces on the plasma parameters given their contributions from secondary electrons and ions. This paper briefly reviews the known surface interaction processes as well as currently available diagnostics to study the interface between plasmas and surfaces. Next comes a discussion describing the application of plasma-modulated electroreflectance to this research and some potential experimental techniques.

DOE

Plasma Interactions; Plasma Diagnostics; Surface Reactions; Metal Surfaces; Plasma Jets

19960024901; 96N27039 Oak Ridge National Lab., TN USA

Tritium projectiles for fueling magnetic fusion plasmas

Fisher, P. W., Oak Ridge National Lab., USA; Gouge, M. J., Oak Ridge National Lab., USA; 1995, pp. 12; In English; 46th; Meeting of the Aeroballistic Range Association, 18-21 Sep. 1995, Minnetonka, MN, USA

Contract(s)/Grant(s): DE-AC05-84OR-21400

Report No.(s): CONF-9509299-1; DE96-005423; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As part of the InterNational Thermonuclear Engineering Reactor (ITER) plasma fueling development program, Oak Ridge National Laboratory (ORNL) has fabricated a pellet (cylindrical projectile of frozen hydrogenic gas at a temperature in the range 6-16 K) injection system to test the mechanical and thermal properties of extruded tritium, a radioactive isotope of hydrogen. This repeating, single-stage, pneumatic injector, called the Tritium-Proof-of-Principle Phase 2 (TPOP-2) Pellet Injector, has a piston-driven mechanical extruder and is designed to extrude and accelerate hydrogenic pellets sized for the ITER device. The TPOP-2 program has the following development goals: evaluate the feasibility of extruding tritium and deuterium-tritium (D-T) mixtures for use in future pellet injection systems; determine the mechanical and thermal properties of tritium and D-T extrusions; integrate, test, and evaluate the extruder in a repeating, single-stage light gas gun that is sized for the ITER application (pellet diameter (approximately) 7 to 8 mm); evaluate options for recycling propellant and extruder exhaust gas; evaluate operability and reliability of ITER prototypical fueling systems in an environment of significant tritium inventory that requires secondary and room containment systems. In initial tests with deuterium feed at ORNL, up to 13 pellets have been extruded at rates up to 1 Hz and accelerated to speeds of 1.0 to 1.1 km/s, using hydrogen propellant gas at a supply pressure of 65 bar. The pellets, typically 7.4 mm in diameter and up to 11 mm in length, are the largest cryogenic pellets produced by the fusion program to date. These pellets represent about a 11 percent density perturbation to ITER. Hydrogenic pellets will be used in ITER to sustain the fusion power

in the plasma core and may be crucial in reducing first-wall tritium inventories by a process called isotopic fueling in which tritium-rich pellets fuel the burning plasma core and deuterium gas fuels the edge.

DOE

Tritium; Nuclear Fusion; Nuclear Fuels; Deuterium; Injectors; Fabrication; Plasmas (Physics)

19960024902; 96N27040 Lawrence Livermore National Lab., Livermore, CA USA

Simulation of experimentally achieved detached plasmas using the UEDGE code

Porter, Gary D., Lawrence Livermore National Lab., USA; Allen, S., Lawrence Livermore National Lab., USA; Fenstermacher, M., Lawrence Livermore National Lab., USA; Hill, D., Lawrence Livermore National Lab., USA; Jong, R., Lawrence Livermore National Lab., USA; Leonard, T., General Atomics Co., USA; Nilson, D., Lawrence Livermore National Lab., USA; Rensink, M., Lawrence Livermore National Lab., USA; Rognlien, T., Lawrence Livermore National Lab., USA; Smith, G., Lawrence Livermore National Lab., USA; Oct. 30, 1995, pp. 35; In English; 37th; Annual Meeting of the American Physical Society Division of Plasma Physics, 6-10 Nov. 1995, Louisville, KY, USA

Contract(s)/Grant(s): DE-AC03-89ER-51114; W-7405-ENG-48

Report No.(s): UCRL-JC-122501; CONF-951182-6; DE96-005385; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The introduction of a divertor Thomson scattering system in DIII-D has enabled accurate determination of the plasma properties in the divertor region. We identify two plasma regimes; detached and attached. The electron temperature in the detached regime is about 2 eV, much lower than 5 to 10 eV determined earlier. We show that fluid models of the DIII-D scrape-off layer plasma are able to reproduce many of the features of these two plasma regimes, including the boundaries for transition between them. Detailed comparison between the results obtained from the fluid models and experiment suggest the models underestimate the spatial extent of the low temperature region associated the detached plasma mode. We suggest that Atomic physics processes at the low electron temperatures reported here may account for this discrepancy.

DOE

Plasmas (Physics); Tokamak Devices; Divertors (Fusion Reactors); Plasma Diagnostics; Plasma Dynamics; Computer Programs

19960024962; 96N27089 Argonne National Lab., IL USA
Divertor erosion study for TPX and implications for steady-state fusion reactors

Brooks, J. N., Argonne National Lab., USA; 1995, pp. 9; In

English; 16th IEEE/NPSS Symposium on Fusion Engineering, 1 - 5 Oct. 1995, Champaign, IL, USA

Contract(s)/Grant(s): W-31109-ENG-38

Report No.(s): ANL/TD/CP-86511; CONF-9510239-5; DE96-005526; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A sputtering erosion analysis was performed for the tilted plate divertor design of the proposed TPX tokamak. High temperature ((approx.) 100 eV), non-radiative, steady-state compatible, plasma edge conditions were used as input to the REDEP erosion/redeposition code. For the reference carbon surface the results show a stable erosion profile, i.e., non-run-away self-sputtering, in spite of carbon self-sputtering coefficients that are locally in excess of unity. The resulting net erosion rates are high (peak (approx.) 1-2.5 m/burn-yr) but may be acceptable for a low duty factor experimental device such as TPX. Other surface materials were also analyzed, in part to obtain insight for fusion reactor designs using a similar plasma regime. Both medium and high-Z materials are predicted not to work, due to runaway self-sputtering. Beryllium is stable but has erosion rates as high or higher than carbon. A liquid metal lithium surface has stable sputtering with a zero-erosion potential and may thus be an attractive future material choice.

DOE

Tokamak Devices; Sputtering; Erosion; Diverters; Plasmas (Physics); Metal Surfaces; Carbon; Beryllium

19960024963; 96N27090 Argonne National Lab., Energy Technology Div., IL USA

Compatibility of ITER candidate materials with static gallium

Luebbers, P. R., Argonne National Lab., USA; Chopra, O. K., Argonne National Lab., USA; Sep. 1995, pp. 9; In English; 16th; Sofe1995: IEEE/NPSS Symposium on Fusion Engineering, 30 Sep. - 4 Oct. 1995, Champaign, IL, USA

Contract(s)/Grant(s): W-31109-ENG-38

Report No.(s): ANL/ET/CP-86690; CONF-950905-22; DE96-005525; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Corrosion tests have been conducted to determine the compatibility of gallium with candidate structural materials for the InterNational Thermonuclear Experimental Reactor (ITER) first wall/blanket systems, e.g., Type 316 stainless steel (SS), Inconel 625, and Nb-5 Mo-1 Zr. The results indicate that Type 316 SS is least resistant to corrosion in static gallium and Nb-5 Mo-1 Zr alloy is most resistant. At 400 C, corrosion rates for Type 316 SS, Inconel 625, and Nb-5 Mo-1 Zr alloy are (approx) 4.0, 0.5, and 0.03 mm/yr, respectively. Iron, nickel, and chromium react rapidly with gallium. Iron shows greater corrosion than nickel at 400 C ((ge) 88 and 18 mm/yr, respectively). The present study indicates that at temperatures up to 400 C, corrosion occurs primarily by dissolution and is accompanied by formation of metal/gallium

intermetallic compounds. The growth of intermetallic compounds may control the overall rate of corrosion.

DOE

Corrosion Tests; Gallium; Intermetallics; Chromium; Corrosion; Gallium Compounds

19960024969; 96N27095 Argonne National Lab., IL USA
Starlite figures of merit for tokamak current drive: Economic analysis of pulsed and steady state power plants with various engineering and physics performance parameters

Ehst, D. A., Argonne National Lab., USA; Sep. 1995, pp. 9; In English; 16th; SoFe1995: IEEE/NPSS Symposium on Fusion Engineering, 30 Sep. - 4 Oct. 1995, Champaign, IL, USA

Contract(s)/Grant(s): W-31109-ENG-38

Report No.(s): ANL/TD/CP-86630; CONF-950905-23; DE96-005534; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The physics efficiency of current drive (γ)(sub B) (proportional to) n (sub e) I (sub o) R (sub o)/ P (sub CD)), including the bootstrap effect, needs to exceed certain goals in order to provide economical steady state operation compared to pulsed power plants. The goal for γ (sub B) depends not only on engineering performance of the current drive system, but also on normalized beta and the effective safety factor of the achievable MHD equilibrium.

DOE

Fusion Reactors; Magnetohydrodynamics; Economic Analysis; Tokamak Devices

19960024985; 96N27110 Japan Atomic Energy Research Inst., Tokyo, Japan

TSTA/FCU-JFCU tritium experiment on breeding blanket interface under the collaboration of JAERI-US/DOE (extended Annex 4). March 1993

Enoeda, Mikio, Japan Atomic Energy Research Inst., Japan; Yamanishi, Toshihiko, Japan Atomic Energy Research Inst., Japan; Yamada, Masayuki, Japan Atomic Energy Research Inst., Japan; Konishi, Satoshi, Japan Atomic Energy Research Inst., Japan; Okuno, Kenji, Japan Atomic Energy Research Inst., Japan; Willms, Richard S., Japan Atomic Energy Research Inst., Japan; Taylor, David, Japan Atomic Energy Research Inst., Japan; Harbin, Wallace, Japan Atomic Energy Research Inst., Japan; Bartlit, John R., Japan Atomic Energy Research Inst., Japan; Anderson, James L., Japan Atomic Energy Research Inst., Japan; May. 1995, pp. 40; In English Report No.(s): JAERI-Research-95-034; DE95-502139; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Realistic nonsteady-condition experiments were performed of the fuel loop and breeding blanket interface (BBI). It was proposed to use the combination process of cryomolecular sieve bed (CMSB) and palladium diffuser (PD) for the recovery and purification of tritium in the breeding blanket

purge stream. The BBI campaign experiment, which used the CMSB of the Tritium Systems Test Assembly-Fuel Cleanup System (TSTA-FCU) and the PD of the Japan Atomic Energy Research Institute (JAERI) FCU, was performed for the recovery of tritium from the simulated breeding blanket purge stream in the flow rate of 12.6 l/min. It was demonstrated that the proposed combination process has feasibility as the blanket tritium recovery system in a fusion plant. This report summarizes the experimental results and analysis of the simulated BBI experiment.

DOE

Tritium; Blankets (Fusion Reactors); Fusion Reactors; Reactor Design; Nuclear Fuel Reprocessing

19960025067; 96N27192 Peking Univ., Dept. of Physics., China

Modification of Einstein A Coefficient in Dissipative Gas Medium

Cao, Chang-Qi, Peking Univ., China; Cao, Hui, Stanford Univ., USA; Qin, Ke-Cheng, Peking Univ., China; Fourth InterNational Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 553-559; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

Spontaneous radiation in dissipative gas medium such as plasmas is investigated by Langevin equations and the modified Weisskopf-Wigner approximation. Since the refractive index of gas medium is expected to be nearly unity, we shall first neglect the medium polarization effect. We show that absorption in plasmas may in certain case modify the Einstein A coefficient significantly and cause a pit in the A coefficient-density curves for relatively low temperature plasmas and also a pit in the A coefficient-temperature curves. In the next, the effect of medium polarization is taken into account in addition. To our surprise, its effect in certain case is quite significant. The dispersive curves show different behaviors in different region of parameters.

Author

Langevin Formula; Cold Plasmas; Refractivity

19960025079; 96N27204 Hebei Univ., Dept. of Physics., Baoding, China

Quantum Cohesion Oscillation of Electron Ground State in Low Temperature Laser Plasma

Zhao, Qingxun, Hebei Univ., China; Zhang, Ping, Academia Sinica, China; Dong, Lifang, Hebei Univ., China; Zhang, Kaixi, Hebei Univ., China; Fourth InterNational Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 631-633; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A01, Hardcopy; A06, Microfiche

The development of radically new technological and economically efficient methods for obtaining chemical products and for producing new materials with specific properties requires the study of physical and chemical processes pro-

ceeding at temperature of 10(exp 3) to 10(exp 4) K, temperature range of low temperature plasma. In our paper, by means of Wigner matrix of quantum statistical theory, a formula is derived for the energy of quantum coherent oscillation of electron ground state in laser plasma at low temperature. The collective behavior would be important in ion and ion-molecule reactions.

Author

Quantum Theory; Laser Plasmas; Oscillations; Molecular Interactions; Ionic Reactions

19960025286; 96N27359 General Atomics Co., San Diego, CA USA

Plasma rotation and the radial electric field during off-axis NBI in the D3-D tokamak

Gohil, P., General Atomics Co., USA; Burrell, K. H., General Atomics Co., USA; Hassam, A.B., Maryland Univ., USA; Osborne, T. H., General Atomics Co., USA; Dec. 1995, pp. 11; In English; Iaea Technical Committee Meeting/US-Japan Workshop on H-mode Physics, 18-20 Sep. 1995, Princeton, NJ, USA

Contract(s)/Grant(s): DE-AC03-89ER-51114; DE-FG05-86ER-5

Report No.(s): GA-A22183; CONF-9509238-4; DE96-005252; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Experiments have been carried out on the D3-D tokamak to investigate whether off-axis NBI can: (a) drive significant perpendicular flow to lead to increased suppression of turbulence and improved confinement, and (b) be used to control the radial electric field profile. Measurements of both impurity ion poloidal and toroidal rotation profiles were made using charge exchange recombination spectroscopy. These experiments used a low current, low elongation ($I_{sub p} = 0.5$ MA, $(\kappa) = 1.2$) plasma whose magnetic axis was shifted 36 cm vertically upward from the vessel midplane and then shifted downward to be centered on the midplane later in the discharge. 10.7 MW of beam power was applied to maximize NBI effect while operating at low target densities and high temperature to minimize poloidal damping. Results from these experiments show a slight increase in impurity ion poloidal rotation velocity during the vertical shifted phase of off-axis NBI discharge. The toroidal rotation profile is more peaked during off-axis NBI. Both these effects lead to a change in the $V \times B$ contribution to the radial electric field during off-axis NBI.

DOE

Tokamak Devices; Confinement; Electric Fields; Rotation; Plasmas (Physics); Turbulence; Charge Exchange

19960025287; 96N27360 General Atomics Co., San Diego, CA USA

Transition physics and scaling overview

Carlstrom, T. N., General Atomics Co., USA; Dec. 1995, pp.

18; In English; Iaea Technical Committee Meeting/US-Japan Workshop on H-mode Physics, 18-20 Sep. 1995, Princeton, NJ, USA

Contract(s)/Grant(s): DE-AC03-89ER-51114

Report No.(s): GA-A22191; CONF-9509238-6; DE96-005251; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents an overview of recent experimental progress towards understanding H-mode transition physics and scaling. Terminology and techniques for studying H-mode are reviewed and discussed. The model of shear $E \times B$ flow stabilization of edge fluctuations at the L-H transition is gaining wide acceptance and is further supported by observations of edge rotation on a number of new devices. Observations of poloidal asymmetries of edge fluctuations and dephasing of density and potential fluctuations after the transition pose interesting challenges for understanding H-mode physics. Dedicated scans to determine the scaling of the power threshold have now been performed on many machines. A clear $B_{sub t}$ dependence is universally observed but dependence on the line averaged density is complicated. Other dependencies are also reported. Studies of the effect of neutrals and error fields on the power threshold are under investigation. The ITER threshold database has matured and offers guidance to the power threshold scaling issues relevant to next-step devices.

DOE

Electric Fields; Shear Flow; Stabilization; Thermonuclear Reactions; Plasma Control; Transition Points

19960025314; 96N27386 China Nuclear Information Centre, Beijing, China

Optical measurements with high spectral resolution on HT-6M tokamak

Ding Liancheng, Academia Sinica, China; Jiang Guangkuan, Academia Sinica, China; Lin Xiaodong, Academia Sinica, China; Nov. 1994, pp. 17; In Chinese

Report No.(s): CNIC-00905; ASIPP-0044.; DE96-609041; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The principle and technique of high-resolution optical measurement on HT-6M tokamak with a scanning Fabry-Perot interferometer is described. Applications of the techniques on HT-6M tokamak, including measurement of $H/H + D$ ratio for determining the energy absorption mechanism of ICRH, ion temperature from line broadening and recycling of edge plasma, are reported.

DOE

Optical Measurement; Tokamak Devices; Energy Absorption; Ion Temperature; Plasma Diagnostics

19960025354; 96N27411 National Inst. for Fusion Science, Nagoya Japan

Dielectronic Recombination Rate Coefficients to the

Excited States of CII from CIII

Kato, T., National Inst. for Fusion Science, Japan; Safronova, U., National Inst. for Fusion Science, Japan; Ohira, M., National Inst. for Fusion Science, Japan; Feb. 1996; 0915-6364, pp. 88; In English
Report No.(s): NIFS-DATA-32; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Energy levels, radiative transition probabilities and auto-ionization rates for CII including $1s(\sup 2)2l2l'nl''$ ($n=2-6$, l' less than or equal to $(n-1)$) states were calculated by using multiconfigurational Hartree-Fock (Cowan code) method. Autoionizing levels above three thresholds: $1s(\sup 2)2s(\sup 2)((\sup 1)S)$, $1s(\sup 2)2s2p((\sup 3)P)$, $1s(\sup 2)2s2p((\sup 1)P)$ were considered. Branching ratios related to the first threshold and the intensity factor were calculated for satellite lines of CII ion. The dielectronic recombination rate coefficients to the excited states for $n=2-6$ are calculated with these Atomic data. The rate coefficients are fitted to an analytical formula and the fit parameters are given. The values for higher excited states than $n=6$ are extrapolated and the total dielectronic recombination rate coefficients are derived. The effective recombination rate coefficient for different electron densities are also derived.

Author

Dielectric Properties; Autoionization; Radiative Transfer; Wavelengths; Ionization Coefficients; Excitation; Electron States

76

SOLID-STATE PHYSICS

Includes superconductivity. For related information, see also 33 Electronics and Electrical Engineering and 36 Lasers and Masers.

19960024102; 96N26673 National Inst. for Fusion Science, Nagoya, Japan

Roles of Atomic and molecular processes in fusion plasma researches. From the cradle (plasma production) to the grave (after-burning)

Tawara, Hiro, National Inst. for Fusion Science, Japan; May 1995, pp. 54; In English

Report No.(s): NIFS-DATA-25; DE96-701328; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This short lecture given at RIKEN Winter School on Atomic and Molecular Processes in Tsunan, Niigata, has described some crucial roles of Atomic and molecular (AM) physics in magnetic fusion plasma research. Particular importance has been stressed of collision processes involving species in the excited states in fusion plasmas, especially in divertor and edge plasmas.

DOE

Atomic Physics; Diverters; Nuclear Fusion; Afterburning; Plasmas (Physics)

19960024107; 96N26678 Argonne National Lab., IL USA **Gauges for the Ginzburg-Landau equations of superconductivity**

Fleckinger-Pelle, Jacqueline, Argonne National Lab., USA; Kaper, Hans G., Argonne National Lab., USA; 1995, pp. 8; In English; InterNational Congress on Industrial and Applied Mathematics, 3-7 Jul. 1995, Hamburg, Germany

Contract(s)/Grant(s): W-31-109-eng-38

Report No.(s): ANL/MCS/CP-87416; CONF-9507214-1; DE96-004826; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This note is concerned with gauge choices for the time-dependent Ginzburg-Landau equations of superconductivity. The equations model the state of a superconducting sample in a magnetic field near the critical temperature. Any two solutions related through a 'gauge transformation' describe the same state and are physically indistinguishable. This 'gauge invariance' can be exploited for analytical and numerical purposes. A new gauge is proposed, which reduces the equations to a particularly attractive form.

DOE

Gauge Invariance; Magnetic Fields; Superconductivity

19960024109; 96N26680 California Univ., Berkeley. Lawrence Berkeley Lab, CA USA

Large diameter lithium compensated silicon detectors for the NASA Advanced Composition Explorer (ACE) mission

Allbritton, G. L., California Inst. of Tech., USA; Cummings, A. C., California Inst. of Tech., USA; Leske, R. A., California Inst. of Tech., USA; Mewaldt, R., California Inst. of Tech., USA; Sears, B. R., California Inst. of Tech., USA; Christian, E. R., National Aeronautics and Space Administration. Goddard Space Flight Center, USA; Dougherty, B. L., National Aeronautics and Space Administration. Goddard Space Flight Center, USA; Madden, M. P., National Aeronautics and Space Administration. Goddard Space Flight Center, USA; Nahory, B. W., National Aeronautics and Space Administration. Goddard Space Flight Center, USA; Oct. 1995, pp. 12; In English; IEEE Nuclear Science Symposium and Medical Imaging Conference, 23-28 Oct. 1995, San Francisco, CA, USA

Contract(s)/Grant(s): AC03-76SF00098; NAS5-32626; NAGW-1919

Report No.(s): NASA-CR-200838; NAS 1.26:200838; LBL-37836; CONF-951073-16; DE96-004747; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Fabrication of the 100 mm diameter, 3 mm thick lithium-compensated silicon, Si(Li), detectors for the Cosmic Ray Isotope Spectrometer (CRIS) instrument on board the ACE satellite required development of: new float-zone silicon growing techniques, new Si(Li) fabrication procedures, and new particle beam testing sequences. These developments are discussed and results are presented that illustrate the advances

made in realizing these CRIS Si(Li) detectors, which, when operational in the CRIS detector telescopes, will usher in a new generation of cosmic-ray isotope spectrometers.

DOE

Crystal Growth; Fabrication; Lithium; Radiation Detectors; Silicon; Cosmic Rays

19960024125; 96N26692 New Energy and Industrial Technology Development Organization, Tokyo, Japan

Research on the silicon light-emitting device with rare earth elements *Kidorui genso tenka silicon hakko device ni kansuru kenkyu*

Mar. 1995, pp. 8; In Japanese

Report No.(s): NEDO-ITK-9403; DE96-736521; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

To prepare the Si-Er materials as a new light-emitting device, a comparative study was made through the Er doping by both ion implantation and laser doping. In case of Er doping by the ion implantation, the crystallinity and light-emitting intensity depend strongly upon the temperature during the post-heating treatment. Though the doping concentration can be accurately controlled by the ion implantation, its future problem is how to obtain the activating energy to restore the crystallinity by the post-heating treatment. In case of Er doping by the laser doping, it was known that the light-emitting spectrum depends strongly upon the post-heating temperature. It was also known that the light-emitting intensity is more than doubled under the existence of oxygen atoms of which the concentration is higher than several ppm in the thermal treatment atmosphere. A new laser doping method in which the repeated irradiation with excimer laser was made by evaporating/depositing the metallic Er was designed, so that an about 700-angstrom layer successfully formed with a homogeneous Er concentration.

DOE

Crystallinity; Luminous Intensity; Ion Implantation; Lasers; Temperature Dependence

19960024176; 96N26733 Atomic Energy of Canada Ltd., Chalk River Nuclear Labs., Chalk River, Ontario Canada

Thermal etching of Zr single crystal surfaces

Zou, H., Atomic Energy of Canada Ltd., Canada; Hood, G. M., Atomic Energy of Canada Ltd., Canada; Schultz, R. J., Atomic Energy of Canada Ltd., Canada; Roy, J. A., Atomic Energy of Canada Ltd., Canada; Dec. 1994, pp. 18; In English Report No.(s): AECL-11187; COG-94-518.; DE96-609390; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

Extensive thermal etching of alpha-Zr single crystals has been found to occur during high-temperature annealing (1090 K) under ultra-high vacuum (less than 1.0×10^{-7} Pa). Two grades of material were examined: Z1 (high purity) and Z2 (nominally pure). Levels of the 'surface active' element, Fe, were about 1 and 50 ppma, in Z1 and Z2, respectively. In

Z1, strong faceting occurred on a high-index surface (8 deg off the 1010 plane) and weak linear facets appeared on the basal (0002) plane. In Z2, etch pits and linear groove defects formed on the (1010) prism plane. Etch-pit formation may be promoted by Fe segregation to dislocations; Fe-rich precipitates were found at the bases of clusters of pits. Etch pit counts were consistent with dislocation densities of about $1.0 \times 10^{11}/\text{m}^2$. The basal plane remained comparatively flat, but Fe-rich, needle-shaped precipitates at 60 deg angles with each other were formed. An analysis of the results implies that the surface energies increase in the order of (0002), (1011) and (1010), and that the etching mechanism is surface diffusion.

DOE

Etching; Single Crystals; Zirconium; Annealing; Crystal Dislocations; Surface Diffusion; Crystal Surfaces

19960024195; 96N26746 Ames Lab., IA USA

Phase relationships and cation disorder in $\text{LRE}(1+x)\text{Ba}(2-x)\text{Cu}_3\text{O}(7+\delta)$, LRE = Pr, Nd, Sm, Gd

Kramer, M. J., Ames Lab., USA; Wu, H., Ames Lab., USA; Dennis, K. W., Ames Lab., USA; Polzin, B. I., Ames Lab., USA; Falzgraf, D. K., Ames Lab., USA; McCallum, R. W., Ames Lab., USA; 1995, pp. 6; In English; 8; InterNational Symposium on Superconductivity, 30 Oct. - 2 Nov. 1995, Hamamatsu, Japan

Contract(s)/Grant(s): W-7405-ENG-82

Report No.(s): IS-M-836; CONF-951078-6; DE96-006798; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

Unlike Y123 which forms only a stoichiometric compound, the light rare earth elements (LRE) form a solid solution $\text{LRE}(1+x)\text{Ba}(2-x)\text{Cu}_3\text{O}(7+\delta)$ ($\text{LRE}_{123\text{ss}}$), with increasing substitution of the LRE($\text{sup } 3+$) for the Ba($\text{sup } 2+$) as the ionic radii of the LRE increases. The sub-solidus phase relationships around the $\text{LRE}_{123\text{ss}}$ change for La, Pr and Nd, but are similar for Sm and Gd. However, the solubility limit decreases with decreasing ionic radii. In addition, the solubility limits for Sm and Gd are strongly influenced by PO_2 during high temperature annealing. The range of solubility is, for any given LRE system, strongly dependent on the oxygen partial pressure PO_2 providing a new means by which to control the microstructure in the RE_{123} system.

DOE

Barium Oxides; Copper Oxides; Rare Earth Elements; Light Elements; Oxygen; Annealing; Cations

19960024212; 96N26761 EG and G Energy Measurements, Inc., Las Vegas, NV USA

Linearity of photoconductive GaAs detectors to pulsed electrons

Ziegler, L.H., EG and G Energy Measurements, Inc., USA; 1995, pp. 11; In English; 9th; InterNational Workshop on Room Temperature Semiconductor X- and Gamma-ray

Detectors, Associated Electronics and Applications, 18 - 22 Sep. 1995, Grenoble, France

Contract(s)/Grant(s): AC08-93NV11265

Report No.(s): EGG-11265-1138; CONF-9509239-4; DE96-004159; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The response of neutron damaged GaAs photoconductor detectors to intense, fast (50 psec fwhm) pulses of 16 MeV electrons has been measured. Detectors made from neutron damaged GaAs are known to have reduced gain, but significantly improved bandwidth. An empirical relationship between the observed signal and the incident electron fluence has been determined.

DOE

Gallium Arsenides; Neutron Counters; Photoconductors; Electron Beams; Pulsed Radiation; Linearity

19960024279; 96N26810 Argonne National Lab., Energy Technology Div., IL USA

Fabrication of superconducting joints for Ag-clad BSCCO conductors

Iyer, A.N., Argonne National Lab., USA; Huang, J.Y., Argonne National Lab., USA; Jammy, R., Argonne National Lab., USA; Halder, P., Intermagnetics General Corp., USA; Jul. 1995, pp. 8; In English; Cryogenic Engineering Conference and International Cryogenic Materials Conference, 17-21 Jul. 1995, Columbus, OH, USA; Limited Reproducibility. More than 20% of this document may be affected by microfiche quality.

Contract(s)/Grant(s): W-31109-ENG-38

Report No.(s): ANL/ET/CP-85330; CONF-950722-17; DE96-007242; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

Potential applications of high-T(sub c) superconductors include motors, generators, transmission cables, magnets, etc. At present, resistive connections are used to connect various high-T(sub c) components for such applications. However, to improve efficiency, it is imperative that the resistive connection be replaced by a true superconducting joint. Using a novel etching technique, we have fabricated superconducting lap and butt joints between Ag-clad BSCCO conductors. The Ag sheath from one side of the tape was selectively etched to expose the underlying superconductor core. Joints were formed by bringing the two tapes together and heat treating them. Detailed microstructural analysis and current transport measurements of the joints have been performed. Critical current (I(sub c)) through a monofilament lap- and butt-joint were 10 and 23 A, respectively. I(sub c) within the joint for mono- and multifilament conductors were 37 and 21 A, respectively. Additionally, effects of various joint configurations, processing techniques, and strain on the transport property of the joint are also being studied.

DOE

Electrical Resistivity; BSCCO Superconductors; Lap Joints; Etching; Superconductivity

19960024327; 96N26844 Brookhaven National Lab., Upton, NY USA

Metallic stripes in high-temperature superconductors

Salkola, M. I., Los Alamos National Lab., USA; Emery, V. J., Brookhaven National Lab., USA; Kivelson, S. A., California Univ., USA; Nov. 23, 1995, pp. 13; In English; 3d; International Conference on Phase Separation In High Tc Superconductors, 10-14 Jul. 1995, Erice, Italy

Contract(s)/Grant(s): DE-AC02-76CH-00016; NSF DMR-93-12606

Report No.(s): BNL-62498; CONF-9507209-1; DE96-004194; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A phenomenological approach is applied to explore signatures of disordered charge stripes and antiphase spin domains in single-particle properties of the high-temperature superconductors. Stripe phases are shown to explain many experimentally observed unusual features measured in angle-resolved photoemission and optical spectroscopy. It is argued that disordered and fluctuating stripe phases are a common feature of high-temperature superconductors, supported by the additional evidence from neutron scattering and NMR.

DOE

High Temperature Superconductors; Nuclear Magnetic Resonance; Phenomenology

19960024332; 96N26849 Carnegie-Mellon Univ., Dept. of Electrical and Computer Engineering., Pittsburgh, PA USA

Structural Characterization of Epitaxial Layers for Infrared Detectors Final Report, 1 Jun. 1993 - 31 May 1995

Greve, D. W., Carnegie-Mellon Univ., USA; Nov. 02, 1995, pp. 13; In English

Contract(s)/Grant(s): F49620-92-J-0285; AF Proj. 3484

Report No.(s): AD-A302057; AFOSR-TR-95-0712; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

UHV/CVD is a growth technique highly suitable for deposition of Ge(x)Si(1-x) heterostructures for long-wavelength infrared detectors. We have used transmission electron microscopy to determine favorable conditions for the growth of these structures. Multiple quantum well structures can be grown with excellent quality without any evidence of nonplanar growth while heterojunction internal photoemission structures incorporated thicker Ge(x)Si(1-x) layers do exhibit nonplanar growth. A modest decrease in growth temperature to 550 C is sufficient to solve the problem.

DTIC

Quantum Wells; Photoelectric Emission; Vapor Deposition; Heterojunctions; Epitaxy; Quantum Electronics

19960024337; 96N26852 Joint Inst. for Nuclear Research, Dubna, USSR

Intergrain magnetization in high-temperature superconductors *Mezhgranul'naya namagnichennost' v vysokotemperaturnykh sverkhprovodnikakh*

Vuong, N. V., Joint Inst. for Nuclear Research, USSR; 1995, pp. 26; In Russian

Report No.(s): JINR-R-17-95-229; DE96-610476; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

The results of intergrain magnetization calculations in high-temperature superconductors in a critical state model with the generalized expression for the critical current density $J_c = (\alpha_0 / (1 - T/T_c))^{1/2} / (B_0 + \text{the absolute value of } B)$ are presented. The temperature and field dependent local fields, magnetic loops and ac-susceptibility are calculated. The procedure of determining parameters of pinning centers is also discussed. The experimental data of temperature dependencies of fundamental ac-susceptibility measured with various ac-field amplitudes are compared with the calculated ones for a YBa₂Cu₃O_{7-(delta)}-ceramic sample.

DOE

YBCO Superconductors; High Temperature Superconductors; Coronal Loops

19960024338; 96N26853 Joint Inst. for Nuclear Research, Dubna, USSR

The influence of the critical fluctuations at the structural phase transition of the superconducting pairing *Vliyanie kriticheskikh fluktuatsij pri strukturnom fazovom perekhode na sverkhprovodnyashchee sparivanie*

Chernyj, A. Yu., Joint Inst. for Nuclear Research, USSR; 1995, pp. 25; In Russian

Report No.(s): JINR-R-17-95-191; DE96-610475; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

The influence of the critical fluctuations in vicinity of the structural phase transition (SPT) on the isotope effect (IE) is studied within the anharmonic model of the high-temperature superconductivity. It is shown that if the superconducting transition temperature T_c is equal to the temperature of SPT then the IE is determined by the critical exponent (γ). In the case (γ) less than 1 the isotope factor for T_c ($\alpha = -\ln T_c / \ln M$) is equal to the factor for the structural transition temperature T_0 (i.e. $\alpha = \epsilon$), where $\epsilon = -\ln T_0 / \ln M$, but in the case (γ) greater than 1 ($\alpha = 1/2$ (if one neglects Coulomb interaction)). This result does not depend on the model for the SPT. The result is demonstrated with the exactly solvable model of the SPT.

DOE

Superconductivity; Isotope Effect; Transition Temperature; Isotopes

19960024339; 96N26854 Joint Inst. for Nuclear Research, Dubna, USSR

EPR and cathodoluminescence of defects in diamond irradiated by nickel ions with energy of 335 MeV *EhPR i kato-dolyuminesentsiya defektov v almaze, obluchennom ionami nikelya s ehnergiej 335 MeV*

Varichenko, V. S., Belarussian State Univ., Byelarus; Martynovich, V. A., Belarussian State Univ., Byelarus; Filipp, A. Z., Belarussian State Univ., Byelarus; Didyk, A. Yu., Joint Inst. for Nuclear Research, USSR; 1995, pp. 14; In Russian

Report No.(s): JINR-R-14-95-180; DE96-610445; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

Defect production in natural diamond irradiated by 335 MeV Ni ions within a dose range of 5×10^{12} - 5×10^{14} cm² has been studied by EPR and cathodoluminescence techniques. It is shown that the high energy ion irradiation leads to the appearance of modified track like one-dimensional structures with nontetrahedral coordination of atoms. A mechanism of microwave conductivity in modified structures of irradiated samples discussed in frame of a model of mobile quasi-particles of corresponding paramagnetic centres. Peculiarities of concentration distributions of paramagnetic centres corresponding to ion-modified structures and cathodoluminescence centres through the irradiated layer are connected with track channeling and stopped of a part of ions because of their elastic collisions with lattice atoms during ion stopping.

DOE

Cathodoluminescence; Diamonds; Electron Paramagnetic Resonance; Ion Irradiation; Metal Ions; Ion Implantation; Crystal Defects

19960024357; 96N26872 Joint Inst. for Nuclear Research, Dubna, USSR

Paramagnetic properties of diamond modified by high energy ion irradiation *Paramagnitnye svoystva almaza, modifitsirovannogo vysokoehnergetichnym ionnym oblucheniem*

Varichenko, V. S., Belarussian State Univ., Byelarus; Martynovich, V. A., Belarussian State Univ., Byelarus; Penina, N. M., Belarussian State Univ., Byelarus; Stel'makh, V. F., Belarussian State Univ., Byelarus; Erchak, D. P., Moscow State Univ., Russia; Zajtsev, A. M., Belarussian State Univ., Byelarus; Didyk, A. Yu., Joint Inst. for Nuclear Research, USSR; 1995, pp. 14; In Russian

Report No.(s): JINR-R-14-95-181; DE96-610446; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

Defect production in the Ia-type diamond irradiated with 63 MeV Cu, 26.7 MeV Ne, 335 MeV Ni ions dose 5×10^{14} cm² has been studied. It has been shown that high energy ion irradiation of the diamond leads to the appearance of tracks quasi-one-dimensional nontetrahedral structures.

The singlet EPR line is a measure of these structures and the consequence of resonance absorption of mobile quasi-particles presumably solitons. Spin waves have been registered in the track-like ion-modified structures for the first time. The anisotropy seems to be determined by the anisotropy of the spin wave excitation in the track-like quasi-one-dimensional structures in the diamond studied.

DOE

Elementary Excitations; Diamonds; Wave Excitation; Irradiation; Anisotropy

19960024358; 96N26873 Joint Inst. for Nuclear Research, Dubna, USSR

Investigation of HTSC films in the region of infrared spectroscopy of the beam of the synchrotron radiation *Issledovaniya VTSP-plenok v oblasti infrakrasnoj spektroskopii na puchke sinkhrotronnogo izlucheniya*

Tyutyunnikov, S. I., Joint Inst. for Nuclear Research, USSR; Shalyapin, V. N., Joint Inst. for Nuclear Research, USSR; Scintee, N. N., Joint Inst. for Nuclear Research, USSR; 1995, pp. 13; In Russian

Report No.(s): JINR-R-14-95-211; DE96-610474; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

The results of the researches made on spectroscopy characteristics of the synchrotron radiation source of the pulsed electron reservoir of parameters: $E(\text{sub } e)$ less than or equal 20 MeV, orbit radius $R = 3-14$ cm and pulsed current $I(\text{sub } e) = 1200$ A are given. The spectral radiation power in nu less than 400 $\text{cm}(\text{exp } -1)$ Hz frequency range twice exceeds all known sources. A method of the measurement of the energetic gap in HTSC films by measurement of the time dependence of detector signals registering the radiation transmitted through the film has been developed. Measurements of the wideness of the energetic gap in YBCO film on a MgO support, which was $2(\Delta) = 20$ MeV at $T = 20$ K are made. The film transmission coefficient dependence on temperature, which was close to the theoretical one, given by the BCS theory is measured. A decrease of transmission at an incident 'white spectrum' of P greater than or equal 10 W was observed in the transmission measurement regime.

DOE

YBCO Superconductors; Synchrotron Radiation; Infrared Spectroscopy; Radiation Sources; Superconducting Films

19960024757; 96N26921 Argonne National Lab., IL USA
High T(sub c) superconductors: New insights from angle-resolved photoemission

Randeria, M., Argonne National Lab., USA; Nov. 1995, pp. 14; In English; 3rd; InterNational Conference on Phase Separation In High T(sub)c Superconductors, 10 - 14 Jul. 1995, Erice, Italy

Contract(s)/Grant(s): W-31109-ENG-38

Report No.(s): ANL/MSD/CP-88348; CONF-9507209-2; DE96-004169; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Recent angle-resolved photoemission (ARPES) studies of the high T(sub c) superconductors by the Argonne group are briefly reviewed. First we discuss sum rules to establish a spectral function interpretation of the data, and the use of ARPES to obtain the momentum distribution. We then apply these ideas to the normal and superconducting state spectra for $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_8$. Among the topics discussed are the Fermi surface, polarization selection rules, bilayer splitting and the superconducting gap.

DOE

Superconductors (Materials); Photoelectric Emission; Fermi Surfaces

19960024796; 96N26955 Brookhaven National Lab., Dept. of Chemistry., Upton, NY USA

Molecular control of electron and hole transfer processes: Theory and applications

Newton, Marshall D., Brookhaven National Lab., USA; Cave, Robert J., Harvey Mudd Coll., USA; 1996, pp. 103; In English

Contract(s)/Grant(s): DE-AC02-76CH-00016

Report No.(s): BNL-62564; DE96-005295; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Recent decades have seen remarkable advances in microscopic understanding of electron transfer (ET) processes in widely ranging contexts, including solid-state, liquid solution, and complex biological assemblies. The primary goal of this chapter is to report recent advances in the modeling, calculation, and analysis of electronic coupling in complex molecular aggregates, thereby allowing an assessment of current progress toward the goal of molecular-level control and design. The control of electron transfer kinetics (i.e., enhancing desired processes, while inhibiting others) involves, of course, system energetics (especially activation and reorganization energies) as well as electronic coupling, which is most directly relevant only after the system has reached the appropriate point (or region) along the reaction coordinate. Nevertheless, to focus the discussion in this chapter, the authors will consider such energetics, and the associated molecular and solvent coordinates which control then, only to the extent that they bear on the analysis of the electronic coupling. In the following sections they first discuss the formulation of basic ET models, including the definition of initial and final states, the role of orbitals and 1-particle models in a many-electron context, the utility of various effective Hamiltonians, and the role of vibronic as well as purely electronic effects. With these theoretical tools in hand, they then examine very recent applications to complex molecular systems using the techniques of computational quantum chemistry, followed by detailed analysis of the numerical results.

They then conclude with some comments regarding the current 'state of the art' and remaining challenges.

DOE

Electron Transfer; Atomic Structure; Kinetic Equations; Complex Systems

19960024802; 96N26961 Sandia National Labs., Albuquerque, NM USA

Real time measurement of epilayer strain using a simplified wafer curvature technique

Floro, J. A., Sandia National Labs., USA; Chason, E., Sandia National Labs., USA; Lee, S. R., Sandia National Labs., USA; 1995, pp. 10; In English; Fall Meeting of the Materials Research Society (MRS), 27 Nov. - 1 Dec. 1995, Boston, MA, USA

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-95-1731C; CONF-951155-25; DE96-004705; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We describe a technique for measuring thin film stress using wafer curvature that is robust, compact, easy to setup, and sufficiently sensitive to serve as a routine diagnostic of semiconductor epilayer strain in real time during MBE or CVD growth. We demonstrate, using growth of SiGe alloys on Si, that the critical thickness for misfit dislocation can clearly be resolved, and that the subsequent strain relaxation kinetics during growth or post-growth annealing are readily obtained.

DOE

Strain Measurement; Curvature; Thin Films; Strain Gages; Semiconductors (Materials); Crystal Growth

19960024874; 96N27013 Lawrence Livermore National Lab., Livermore, CA USA

Molecular dynamics studies of the ion beam induced crystallization in silicon

Marques, L. A., Lawrence Livermore National Lab., USA; Caturla, M. J., Lawrence Livermore National Lab., USA; Huang, H., Lawrence Livermore National Lab., USA; Jan. 23, 1995, pp. 12; In English; Fall Meeting of the Materials Research Society (MRS), 27 Nov. - 1 Dec. 1995, Boston, MA, USA

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): UCRL-JC-122973; CONF-951155-44; DE96-005391; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have studied the ion bombardment induced amorphous-to-crystal transition in silicon using molecular dynamics techniques. The growth of small crystal seeds embedded in the amorphous phase has been monitored for several temperatures in order to get information on the effect of the thermal temperature increase introduced by the incoming ion. The

role of ion-induced defects on the growth has been also studied.

DOE

Crystal Growth; Crystal Defects; Molecular Dynamics; Ion Beams; Crystallization; Amorphous Silicon; Phase Transformations; Ion Irradiation; Microstructure

19960024875; 96N27014 Lawrence Livermore National Lab., Livermore, CA USA

Atomic scale simulations of arsenic ion implantation and annealing in silicon

Caturla, M.-J., Lawrence Livermore National Lab., USA; DiazdelaRubia, T., Lawrence Livermore National Lab., USA; Jaraiz, M., Valladolid Univ., Spain; Gilmer, G. H., Bell Telephone Labs., Inc., USA; Jan. 23, 1995, pp. 12; In English; Fall Meeting of the Materials Research Society (MRS), 27 Nov. - 1 Dec. 1995, Boston, MA, USA

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): UCRL-JC-122966; CONF-951155-42; DE96-005390; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present results of multiple-time-scale simulations of 5, 10 and 15 keV low temperature ion implantation of arsenic on silicon (100), followed by high temperature anneals. The simulations start with a molecular dynamics (MD) calculation of the primary state of damage after 10 ps. The results are then coupled to a kinetic Monte Carlo (MC) simulation of bulk defect diffusion and clustering. Dose accumulation is achieved considering that at low temperatures the damage produced in the lattice is stable. After the desired dose is accumulated, the system is annealed at 800 C for several seconds. The results provide information on the evolution for the damage microstructure over macroscopic length and time scales and affords direct comparison to experimental results. We discuss the database of inputs to the MC model and how it affects the diffusion process.

DOE

Microstructure; Molecular Dynamics; Annealing; Ion Implantation; Arsenic; Silicon; Crystal Defects

19960024880; 96N27019 Oak Ridge National Lab., TN USA

The mechanisms of iron gettering in silicon by boron ion-implantation

Myers, S. M., Sandia National Labs., USA; Haynes, T. E., Oak Ridge National Lab., USA; Benton, J. L., Bell Telephone Labs., Inc., USA; Stolk, P. A., Bell Telephone Labs., Inc., USA; Eaglesham, D. J., Bell Telephone Labs., Inc., USA; Jacobson, D. C., Bell Telephone Labs., Inc., USA; Cheng, J.-Y., Bell Telephone Labs., Inc., USA; Poate, J. M., Bell Telephone Labs., Inc., USA; May 1995, pp. 13; In English; 5th; InterNational Symposium on ULSI Science and Technology, 21-26 May 1995, Reno, NV, USA

Contract(s)/Grant(s): AC05-84OR21400

Report No.(s): CONF-950518-18; DE96-005438; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

Understanding and controlling gettering will become more important to future device technologies. In this work the authors show that regions of high B concentrations are particularly effective gettering agents. This behavior can be entirely understood in terms of Fermi-level-enhanced pairing reactions between Fe and B which becomes operative at temperatures less than 600 C. Such quantitative understanding could have significance for the development of more efficient gettering protocols.

DOE

Boron; Getters; Semiconductor Devices; Ion Implantation; Silicon

19960024905; 96N27043 Oak Ridge National Lab., Solid State Div., TN USA

New insights into the kinetics of the stress-driven 2D to 3D transition

Chen, K. M., Oak Ridge National Lab., USA; Jesson, D. E., Oak Ridge National Lab., USA; Pennycook, S. J., Oak Ridge National Lab., USA; Thundat, T., Oak Ridge National Lab., USA; Warmack, R. J., Oak Ridge National Lab., USA; Sep. 1995, pp. 14; In English; 15th; North American Conference on Molecular Beam Epitaxy, 17 - 20 Sep. 1995, College Park, MD, USA

Contract(s)/Grant(s): DE-AC05-84OR-21400

Report No.(s): CONF-9509311-1; DE96-005990; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

The authors have systematically investigated the morphological evolution of Ge(0.5)Si(0.5) strained films during post-growth annealing. The changes of the surface structure are found to follow the kinetic route of strain relaxation at different stages. A number of interesting features are revealed, which include the existence of an energy barrier to the 2D/3D transition, and a self-limiting effect in the growth kinetics of strained 3D islands. They demonstrate that the annealing approach provides a new way to grow coherent islands with uniform size.

DOE

Germanium Alloys; Annealing; Crystal Growth; Molecular Beam Epitaxy; Electron Diffraction; Relaxation (Mechanics); Metal Films; Surface Properties

19960024959; 96N27086 Argonne National Lab., IL USA
Explosive consolidation of (Bi,Pb)-Sr-Ca-Cu-O superconductor powders during powder-in-tube processing

Thomas, H., New Mexico Inst. of Mining and Technology, USA; Inal, O. T., New Mexico Inst. of Mining and Technology, USA; Balachandran, U., Argonne National Lab., USA; Aug. 1995, pp. 13; In English; Materials Week 1995, 29 Oct. - 2 Nov. 1995, Cleveland, OH, USA

Contract(s)/Grant(s): W-31109-ENG-38

Report No.(s): ANL/ET/CP-86054; CONF-951026-8; DE96-005530; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Superconducting (2212) Bi-Sr-Ca-Cu-O (BSCCO) and BSCCO-Ag composites were explosively consolidated in silver tubing and then drawn and rolled into tapes. The silver-sheathed tapes were then subjected to repeated cycles of pressing and heat treatment, which resulted in enhanced texturing and grain growth and a subsequent increase in critical current density ($J_{sub c}$). The effect of silver flake additions to the superconducting powder further increased texturing and $J_{sub c}$, with optimal properties occurring in powders with 10 vol.% silver flake. Density measurements on the superconductor tapes showed that near-theoretical densities had been achieved at the end of the thermomechanical treatment (TMT). Scanning electron microscopy indicated that grain alignment increased after TMT, with an apparent reduction in grain size after the fourth treatment. X-ray diffraction studies showed that grain orientation and conversion of 2212 to Bi₂Sr₂Ca₂Cu₃O(10-x) are improved when explosive consolidation is introduced before the drawing step in the powder-in-tube process.

DOE

Bismuth Oxides; Copper Oxides; Calcium Oxides; Thermo-mechanical Treatment; Superconductors (Materials); BSCCO Superconductors; Heat Treatment; Powder (Particles); Consolidation

19960024960; 96N27087 Oak Ridge National Lab., TN USA

Deformation twinning of non-stoichiometric Ti₃Al alloy

Lee, J. W., Tohoku Univ., Japan; Hanada, S., Tohoku Univ., Japan; Yoo, M. H., Oak Ridge National Lab., USA; [1995], pp. 6; In English; 2nd; Pacific Rim InterNational Conference on Advanced Materials and Processing (Prim-2), 18 - 22 Jun. 1995, Kyongju, Korea, Republic of

Contract(s)/Grant(s): DE-AC05-84OR-21400

Report No.(s): CONF-9506209-2; DE96-005648; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

Non-stoichiometric Ti₃Al polycrystals with DO(sub 19) structure have been deformed in compression to a true strain of about 8% at temperatures ranging from 973 K to 1,373 K and at an initial strain rate of $1.3 \times 10^{(exp -4)}$ /s. Deformation modes are observed focusing on twinning. It is found that deformation twinning of non-stoichiometric Ti₃Al occurs in the temperature range of 1,073 K to 1,373 K. Crystallographic characteristics of deformation twinning systems are revealed by optical and transmission electron microscopy and X-ray Laue method. It is shown that most deformation twins are macroscopically lens-shaped and their width is increased with increasing temperature. Also, the volume fraction of deformation twins is increased with increasing strain at 1,273

K and temperature in the range of 1,073 K to 1,273 K. A dominant deformation twinning system observed in the samples deformed at temperatures from 1,073 K to 1,373 K is identified as $(112'2)(112'3')$. $/112'4/$ and $/101'1/$ twins are also operative with a low density.

DOE

Titanium Alloys; Aluminum Alloys; Mechanical Twinning; Crystal Defects; Deformation; Temperature Dependence

19960024970; 96N27096 Los Alamos National Lab., Center for Materials Science., NM USA

Microstructural study of CMR films as a function of growth temperature as-deposited and annealed

Hawley, M. E., Los Alamos National Lab., USA; Wu, X. D., Los Alamos National Lab., USA; Arendt, P. N., Los Alamos National Lab., USA; Adams, C. D., Los Alamos National Lab., USA; Hundley, M. F., Los Alamos National Lab., USA; Heffner, R. H., Los Alamos National Lab., USA; 1995, pp. 7; In English; Fall Meeting of the Materials Research Society (MRS), 27 Nov. - 1 Dec. 1995, Boston, MA, USA

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-95-4494; CONF-951155-49; DE96-007299; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

The properties encompassed by the family of complex metal oxides span the spectrum from superconductors to insulating ferroelectrics. Included in this family are the new colossal magneto-resistive perovskites with potential applications in advanced high density magnetic data storage devices based on single or multilayer thin films units of these materials fabricated by vapor phase deposition (VPD) methods. The realization of this potential requires solving basic thin film materials problems requiring understanding and controlling the growth of these materials. Toward this end, we have grown $\text{La}_{0.7}\text{Ca}_{0.3}\text{MnO}_3$ and $\text{La}_{0.7}\text{Sr}_{0.3}\text{MnO}_3$ on LaAlO_3 single crystal substrates by pulsed laser and RF sputter deposition at 500 to 900 C and annealed at over 900 C for about 10 hours. The evolution of the microstructure of these films was studied by scanning probe microscopies and transmission electron microscopy (TEM). Results of SPM characterization showed that at the lower end of the growth temperature range, the as-grown films were polygranular with grain size increasing with temperature. The 500 C as-grown films appeared to be amorphous while the 750 C film grains were layered with terrace steps often one unit cell high. In contrast, films grown at 900 C consisted of coalesced islands with some 3-D surface crystals. After annealing, all films had coalesced into very large extended layered islands. The change in microstructure was reflected in a decreased resistivity of coalesced films over their unannealed granular precursors. Previous reported work on the growth of $\text{La}_{0.84}\text{Sr}_{0.16}\text{MnO}_3$ and $\text{La}_{0.8}\text{Sr}_{0.2}\text{CoO}_3$ grown demonstrated the sensitivity of the microstructure to substrate

and deposition conditions. Films grown on an 'accidental' vicinal surface grew by a step flow mechanism.

DOE

Microstructure; Temperature Dependence; Magnetic Storage; Laser Deposition; Annealing; Metal Oxides; Perovskites

19960025211; 96N27291 Brookhaven National Lab., Upton, NY USA

Deep electronic levels in high-pressure Bridgman $\text{Cd}_{1-x}\text{Zn}_x\text{Te}$

Szeles, C., Brookhaven National Lab., USA; Shan, Y. Y., Brookhaven National Lab., USA; Lynn, K. G., Brookhaven National Lab., USA; 1995, pp. 17; In English; 9th International Workshop on Room Temperature Semiconductor X- and Gamma-ray Detectors, Associated Electronics and Applications, 18 - 22 Sep. 1995, Grenoble, France

Contract(s)/Grant(s): DE-AC02-76CH-00016

Report No.(s): BNL-62367; CONF-9509239-3; DE96-003126; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The behavior of deep electronic levels was studied as a function of Zn concentration in CdZnTe crystals grown by the high-pressure Bridgman technique using thermoelectric effect spectroscopy. A significant increase of the thermal ionization energies of hole traps was observed with the increasing Zn content of the ternary compound. The effect explains the stronger hole trapping and the resulting much shorter hole lifetime usually observed in CdZnTe as compared to CdTe . The behavior also suggests increased carrier recombination and explains the strong deterioration of electron collection in detectors fabricated from CdZnTe of high Zn concentration.

DOE

Energy Levels; Cadmium Tellurides; Zinc Tellurides; Trapping; Concentration (Composition)

19960025247; 96N27321 Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Protvino, USSR

New solution of vertex type tetrahedron equations

Mangazeev, V. V., Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, USSR; Sergeev, S. M., Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, USSR; Stroganov, Yu. G., Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, USSR; 1994, pp. 14; In English

Report No.(s): IHEP-94-106; DE96-607042; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

In this paper we formulate a new N-state spin integrable model on a three-dimensional lattice with spins interacting round each elementary cube of the lattice. This model can be also reformulated as a vertex type model. Weight functions of the model satisfy tetrahedron equations.

DOE

Mathematical Models; Lattices (Mathematics); Three Dimensional Models; Weighting Functions

19960025255; 96N27329 California Univ., Engineering Div., Berkeley. Lawrence Berkeley Lab, CA USA

Performance of CdZnTe coplanar-grid gamma-ray detectors

Luke, P. N., California Univ., USA; Eissler, E. E., Two-Six, Inc., USA; Nov. 1995, pp. 13; In English; IEEE Nuclear Science Symposium and Medical Imaging Conference, 23-28 Oct. 1995, San Francisco, CA, USA

Contract(s)/Grant(s): DE-AC03-76SF-00098

Report No.(s): LBL-37962; CONF-951073-17; DE96-004727; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

CdZnTe crystals grown using the high-pressure Bridgman method exhibit many properties that are desirable for radiation detector fabrication, such as high resistivity, stable operation, relative ease of processing, and the availability of large volume crystals. However, as is common with other compound semi-conductor materials, currently available CdZnTe crystals have poor charge transport characteristics. This seriously degrades the spectral performance of detectors, especially in gamma-ray detection. The coplanar-grid detection technique was recently developed to address such charge collection problems. This technique was first demonstrated using a 5 mm cube CdZnTe detector, and a dramatic improvement in spectral response has been achieved. These early results verified the effectiveness of this technique and suggested that large-volume gamma-ray detectors with high energy resolution can be realized. To further the development of such detectors, it is important to understand the various factors that affect detector performance. The purpose of this paper is to examine the effects of material properties on the spectral performance of CdZnTe coplanar-grid detectors. Theoretical spectral response is to show the level of performance that can be achieved given the typical carrier mobility-lifetime ($\mu(\tau)$) properties of present-day materials. Nonuniformity in the charge transport properties of the material, which could limit the energy resolution of the detectors, has been studied experimentally and some of the results are presented here.

DOE

Bridgman Method; Transport Properties; Carrier Mobility; Radiation Detectors; Gamma Ray Spectrometers; Semiconductors (Materials); Cadmium Tellurides; Zinc Tellurides

19960025290; 96N27363 Oak Ridge National Lab., Solid State Div., TN USA

Phonon Knudsen flow in GaAs/AlAs superlattices

Hyldgaard, Per, Oak Ridge National Lab., USA; Mahan, Gerald D., Oak Ridge National Lab., USA; Sep. 1995, pp. 6; In English; 23rd; International Thermal Conductivity Conference, 29 Oct. - 1 Nov. 1995, Nashville, TN, USA

Contract(s)/Grant(s): DE-AC05-84OR-21400

Report No.(s): CONF-9510111-1; DE96-004563; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The measured in-plane thermal conductivity, $(\Delta)_{\text{SL}}$ of GaAs/AlAs superlattices with even moderate layer thicknesses are significantly smaller than the weighted average, $(\Delta)_{\text{SL}} = 67 \text{ W/Km}$, of the bulk GaAs and AlAs conductivities. One expects a suppression of the thermal conductivity to that of an actual Al(0.5)Ga(0.5)As alloy when the thickness of the GaAs and AlAs layers approaches that of a single monolayer. However, the observed superlattice thermal conductivity remains suppressed even at layer thickness greater than or approx. equal to 10 nm. The low thermal conductivities, and very high mobilities, make n-doped GaAs/AlAs superlattices attractive possibilities for thermoelectric devices. With Molecular-Beam-Epitaxial grown GaAs/AlAs superlattices one can expect the individual GaAs and AlAs layers to be extremely clean. Defect and/or alloy scattering is limited to be near the heterostructure interfaces. The authors estimate the room-temperature phonon mean-free-path to be 42 (22) nm for the longitudinal (transverse) mode and thus comparable to or smaller than the layer thicknesses. Thus they expect an important phonon scattering at the interfaces. They study this phonon scattering at the superlattice interfaces assuming a Knudsen flow characterized by diffusive scattering. The solid curve in the figure shows the Knudsen-flow theory estimated for the superlattice thermal conductivity which shows a significant reduction when the layer thickness is shorter than the estimated phonon mean free paths.

DOE

Aluminum Arsenides; Mean Free Path; Molecular Beam Epitaxy; Gallium Arsenides; Thermal Conductivity; Superlattices; Flow Theory

19960025296; 96N27369 Brookhaven National Lab., Physics Dept., Upton, NY USA

A study of the timing properties of Cd(0.9)Zn(0.1)Te

Parnham, K. B., Two-Six, Inc., USA; Eissler, E. E., Two-Six, Inc., USA; Jovanovic, S., Brookhaven National Lab., USA; Lynn, K. G., Brookhaven National Lab., USA; 1995, pp. 8; In English; IEEE Nuclear Science Symposium and Medical Imaging Conference, 23-28 Oct. 1995, San Francisco, CA, USA

Contract(s)/Grant(s): DE-AC02-76CH-00016

Report No.(s): BNL-62301; CONF-951073-11; DE96-004164; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

CdZnTe has become a material of great interest in the field of X- and (gamma)-ray imaging, and shows great promise as a highly efficient, room-temperature operation detector. However, data on the timing resolution obtainable with this material is scarce. It is known that CdZnTe, in common with all compound semi-conductors, gives pulses of varying rise-time depending on the interaction location, hence causing a broadening of the time spectrum. We therefore assembled and characterized an appropriate electronic measuring set-up and took data with 2 different sets of detectors, varying the experi-

mental parameters such as bias voltage, threshold and temperature during the course of the experiment. The results obtained with planar detectors of 9 sq. mm x 2 mm thick were superior to the results obtained with detectors of 25 sq. mm x 10 mm thick, even when the difference in effective bias field strength is considered. Timing resolutions of 5.3 ns and 20.9 ns (FWHM) respectively were obtained. Reducing the temperature to 0 C reduced the resolution to 4.5 ns, thereby indicating that the performance is limited by signal-to-noise ratio considerations.

DOE

Semiconductors (Materials); Cadmium Tellurides; Zinc Tellurides; Radiation Detectors; Time Dependence

19960025305; 96N27377 Argonne National Lab., Materials Science Div., IL USA

Effects of c-axis Josephson coupling on dissipation, flux dynamics and the mechanism of high-T_c superconductivity Gray, K. E., Argonne National Lab., USA; Hettinger, J. D., Argonne National Lab., USA; 1995, pp. 11; In English; High T(sub C) Superconductivity Conference, 15-17 Aug. 1995, Youngpyung, Korea, Republic of
Contract(s)/Grant(s): W-31109-ENG-38

Report No.(s): ANL/MSD/CP-87633; CONF-9508207-2; DE96-004778; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Measurements of the c-axis transport in highly anisotropic HTS materials strongly indicate that Josephson coupling is involved. This conclusion affects various properties of the HTS cuprates, including the irreversibility behavior for transport in the ab planes, the direct c-axis transport and potentially the mechanism of Cooper pairing.

DOE

High Temperature Superconductors; Josephson Junctions; Dissipation; Superconductivity

19960025321; 96N27392 Lawrence Livermore National Lab., Livermore, CA USA

Phase transitions in ammonium perchlorate to 26 GPa and 700 K in a diamond anvil cell

Foltz, M. Frances, Lawrence Livermore National Lab., USA; Maienschein, Jon L., Lawrence Livermore National Lab., USA; Jul. 10, 1995, pp. 11; In English; American Physical Society Biennial Conference on Shock Compression of Condensed Matter, 13-18 Aug. 1995, Seattle, WA, USA

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): UCRL-JC-120395; CONF-950846-68; DE96-002642; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Ammonium perchlorate (AP) showed previously unreported phase behavior when studied in a diamond anvil cell (DAC) at high temperature (to 693 K) and high pressure (to approx. 26 GPa). Liquid droplets, observed above the known 513 K orthorhombic-to-cubic phase transition, are interpreted

as the onset to melting. The melting point decreased with increasing pressure. Mid-infrared FTIR spectra of the residue showed only AP. The AP melt may contribute to shock insensitivity of AP-based propellants. Gas formation was seen at higher temperatures. A phase diagram was constructed using the appearance of liquid and gas as solid-liquid and liquid-gas transitions. Preliminary pressurized differential scanning calorimetry data showed a weak pressure dependence (to approx. 6.9 MPa) for the orthorhombic-to-cubic phase transition.

DOE

Ammonium Perchlorates; Phase Transformations; Melting; Propellants; Melting Points; Drops (Liquids); High Pressure

19960025323; 96N27394 California Univ., Dept. of Electrical and Computer Engineering., Santa Barbara, CA USA
High Power, High Efficiency MESFETs and HEMTs Final Report, 15 Jun. 1992 - 14 Jun. 1995

Mishra, Umesh K., California Univ., USA; Jun. 14, 1995, pp. 9; In English

Contract(s)/Grant(s): F49620-92-J-0366; AF Proj. 3484

Report No.(s): AD-A301962; AFOSR-TR-95-0765; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

For the duration of the project dated above, the work on the AASERT program concentrated on improving the power performance of GaAs MESFETs with LTG GaAs surface passivation layers by studying the effects of source and drain contacts regrown by MOCVD on both device breakdown and gain.

DTIC

Gallium Arsenides; Metalorganic Chemical Vapor Deposition; Field Effect Transistors; High Gain

19960025378; 96N27420 California Univ., Dept. of Electrical and Computer Engineering., Santa Barbara, CA USA
The Study of the Materials Properties of LTG (Al) GaAs and its Electronic and Opto-Electronic Device Applications Final Report, 15 Nov. 1993 - 14 Nov. 1995

Mishra, Umesh K., California Univ., USA; Nov. 14, 1995, pp. 24; In English

Contract(s)/Grant(s): F49620-94-1-0040; AF Proj. 2305

Report No.(s): AD-A301931; AFOSR-TR-95-0768; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

GaAs based semiconductors grown at a low temperature (LTG) by MBE have several interesting properties which can be exploited for a variety of applications both electronic and optoelectronic. The material exhibits a range of resistivity from highly conductive to highly resistive based on the growth temperature and subsequent annealing temperature. The most important applications of LTG GaAs and AlGaAs use the highly resistive form of the material. This final report will summarize the understandings and applications of LTG (Al, Ga)As in microelectronics for the duration of the project funded by the AFOSR.

DTIC

Aluminum Gallium Arsenides; Microelectronics; Gallium Arsenides; Optoelectronic Devices; Electrical Resistivity; Temperature Dependence

19960025381; 96N27423 Lawrence Livermore National Lab., Livermore, CA USA

2D and 3D ablation front hydrodynamic instability experiments on Nova

Remington, B. A., Lawrence Livermore National Lab., USA; Marinak, M. M., Lawrence Livermore National Lab., USA; Weber, S. V., Lawrence Livermore National Lab., USA; Budil, K. S., Lawrence Livermore National Lab., USA; Landen, O. L., Lawrence Livermore National Lab., USA; Haan, S. W., Lawrence Livermore National Lab., USA; Kilkenny, J. D., Lawrence Livermore National Lab., USA; Wallace, R. J., Lawrence Livermore National Lab., USA; Apr. 12, 1995, pp. 11; In English; 12th; InterNational Conference on Laser Interaction and Related Plasma Phenomena, 24-28 Apr. 1995, Osaka, Japan

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): UCRL-JC-119388; CONF-950476-14; DE96-004653; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Single-mode experiments have been conducted on the Nova laser to examine the effect of perturbation shape on ablation front Rayleigh-Taylor growth. The perturbations investigated had the same magnitude wave vector $k = (k_x \exp 2 + k_y \exp 2) \exp 1/2$ and the same initial amplitude. The shapes corresponded to 2D $\lambda = 50$ (μ)m, 3D square $k_x = k_y$, and stretched $k_x = 3k_y$ perturbations. We observed that the 3D perturbations grew more than the 2D perturbation. Numerical simulations in 2D and 3D are in agreement, showing the most symmetric modes growing the largest.

DOE

Laser Ablation; Three Dimensional Models; Two Dimensional Models; Perturbation; Computerized Simulation; Nova Laser System

19960025383; 96N27425 Oak Ridge National Lab., TN USA

Microdiffraction measurements of the effects of grain alignment on critical current in high temperature superconductors

Specht, E. D., Oak Ridge National Lab., USA; Goyal, A., Oak Ridge National Lab., USA; 1995, pp. 14; In English; 40th; Annual Meeting of the Society of Photo-optical Instrumentation Engineers, 9-14 Jul. 1995, San Diego, CA, USA

Contract(s)/Grant(s): DE-AC05-84OR-21400

Report No.(s): CONF-950793-50; DE96-004400; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

While single crystals and epitaxial thin films of high temperature superconductors can carry large current densities, devices useful for applications such as power transmission

and magnets cannot be produced because polycrystalline material cannot carry sufficient current densities. Efforts are underway to produce polycrystalline material in which grains are aligned to carry high current densities. We report x-ray and electron microdiffraction measurements of local grain alignment and models of how this grain alignment affects the critical current densities. $\text{TiCa}_2\text{Sr}_2\text{Cu}_3\text{O}(x)$ samples can be grown on polycrystalline substrates with good c axis alignment but no overall (α) axis alignment. In $\text{TiCa}_2\text{Sr}_2\text{Cu}_3\text{O}(x)$, high critical current occurs in regions in which there is local (α) axis alignment. X-ray microdiffraction measurements of grain orientation were made with a monochromatic, 100 microns diameter beam produced by inserting a pinhole at the focus of an NSLS bending magnet beamline. Local grain orientation was measured by observing Bragg reflection as the sample was rotated. While x-ray data was taken at this low resolution over large areas, the orientation of individual grains was measured over small regions by measuring the Kikuchi pattern produced by inelastic scattering from a 100 microns electron beam. In both cases, the sample position was scanned to map grain orientation. With advanced x-ray optics currently under development, high-resolution maps of grain orientation will be available without the elaborate surface preparation required for electron diffraction. This will facilitate study of samples prepared in a wider variety of forms.

DOE

Polycrystals; Crystal Structure; High Current; Current Density; Single Crystals; Alignment; Superconducting Films; Microstructure; Instrument Orientation; Thin Films

19960025418; 96N27456 Oregon Univ., Dept. of Physics., Eugene, OR USA

Surface and interface electronic structure Final Report, 1 Dec. 1994 - 30 Nov. 1995

Kevan, S. D., Oregon Univ., USA; 1995, pp. 23; In English Contract(s)/Grant(s): FG06-86ER45275

Report No.(s): DOE/ER/45275-7; DE96-007119; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A year and a half ago, we terminated our operations at the National Synchrotron Light Source and moved our research program to the Advanced Light Source in Berkeley. This move was motivated primarily by the exciting possibilities and research directions made possible by operation at the newer ALS facility. The ALS facility was commissioned in October 1993. We are members of a 'Participating Research Team' (PRT) associated with undulator beamline 7.0 at the ALS. This beamline was commissioned for experiments the following winter and spring of 1994. We have thus had about a year to debug the beamline and to try to get some experiments accomplished. Reportedly due to insufficient operating funds, the facility provided beam to users only nine 8-hour shifts per week. In the past year, our program has been devoted primarily to becoming operational at the ALS and to assem-

bling experiments and experimental equipment associated with our program there.

DOE

Physical Properties; X Ray Sources; Light Sources; Atomic Structure; Photoelectric Emission

19960025442; 96N27479 Georgia Inst. of Tech., School of Materials Science and Engineering., Atlanta, GA USA

Characterization of zinc selenide single crystals

Gerhardt, Rosario A., Georgia Inst. of Tech., USA; Research Reports: 1995 NASA/ASEE Summer Faculty Fellowship Program; Feb. 1996, pp. 8; In English; Also announced as 1996043981; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

ZnSe single crystals of high quality and low impurity levels are desired for use as substrates in optoelectronic devices. This is especially true when the device requires the formation of homoepitaxial layers. While ZnSe is commercially available, it is at present extremely expensive due to the difficulty of growing single crystal boules with low impurity content and the resultant low yields. Many researchers have found it necessary to heat treat the crystals in liquid Zn in order to remove the impurities, lower the resistivity and activate the photoluminescence at room temperature. The physical vapor transport method (PVT) has been successfully used at MSFC to grow many single crystals of II-VI semiconducting materials including ZnSe. The main goal at NASA has been to try to establish the effect of gravity on the growth parameters. To this effect, crystals have been grown vertically upwards or horizontally. Both (111) and (110) oriented ZnSe crystals have been obtained via unseeded PVT growth. Preliminary characterization of the horizontally grown crystals has revealed that Cu is a major impurity and that the low temperature photoluminescence spectra is dominated by the copper peak. The ratio of the copper peak to the free exciton peak is being used to determine variations in composition throughout the crystal. It was the intent of this project to map the copper composition of various crystals via photoluminescence first, then measure their electrical resistivity and capacitance as a function of frequency before proceeding with a heat treatment designed to remove the copper impurities. However, equipment difficulties with the photoluminescence set up, having to establish a procedure for measuring the electrical properties of the as-grown crystals and time limitations made us re-evaluate the project goals. Vertically grown samples designated as ZnSe-25 were chosen to be measured electrically since they were not expected to show as much variation in their composition through their cross-section as the horizontally grown samples.

Author

Zinc Selenides; Single Crystals; Crystal Growth; Gravitational Effects; Photoluminescence; Copper; Electrical Resistivity; Capacitance; Optoelectronic Devices; Microgravity

19960025481; 96N27518 Alabama A & M Univ., Dept. of Engineering Technology., Huntsville, AL USA

Non-linear resonance of fluids in a crystal growth cavity

Wang, Francis C., Alabama A & M Univ., USA; Research Reports: 1995 NASA/ASEE Summer Faculty Fellowship Program; Feb. 1996, pp. 8; In English; Also announced as 1996043981; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

In the microgravity environment, the effect of gravity on fluid motion is much reduced. Hence, secondary effects such as vibrations, jitters, surface tension, capillary effects, and electromagnetic forces become the dominant mechanism of fluid convection. Numerous studies have been conducted to investigate fluid behavior in microgravity with the ultimate goal of developing processes with minimal influence from convection. Industrial applications such as crystal growth from solidification of melt and protein growth for pharmaceutical application are just a few examples of the vast potential benefit that can be reaped from material processing in space. However, a space laboratory is not immune from all undesirable disturbances and it is imperative that such disturbances be well understood, quantifiable, and controlled. Non-uniform and transient accelerations such as vibrations, jitters, and impulsive accelerations exist as a result of crew activities, space vehicle maneuvering, and the operations of on-board equipment. Measurements conducted on-board a U.S. Space-lab showed the existence of vibrations in the frequency range of 1 to 100 Hz with a dominant mode of 17 Hz and harmonics of 54 Hz. The observed vibration is not limited to any coordinate plane but exists in all directions. Similar situation exists on-board the Russian MIR space station. Due to the large structure of its design, the future InterNational Space Station will have its own characteristic vibration spectrum. It is well known that vibration can exert substantial influence on heat and mass transfer processes, thus hindering any attempts to achieve a diffusion-limited process. Experiments on vibration convection for a liquid-filled enclosure under one-g environment showed the existence of different flow regimes as vibration frequency and intensity changes. Results showed the existence of a resonant frequency, near which the enhancement is the strongest, and the existence of a high frequency asymptote. Numerical simulations of vibration convection have been conducted by Yurkov, Fu and Shieh, and by Wang. These analyses considered a two-dimensional air-filled cell under weightlessness condition and showed results similar to those of the experiments. It is not yet known whether resonance convection can be triggered by jitter alone or whether it requires the interaction of jitter with other convective forces in low gravity. An order of magnitude analysis, however, can be used to show the dependence of the resonance frequency on the fluid Prandtl number. Even though the onset of resonance convection may depend on other factors, results indicates that fluids with low Prandtl numbers are more susceptible to resonance than those with high Prandtl num-

bers. The current study is aimed at gaining additional insights to this problem using germanium as working fluid. Germanium was chosen for this analysis because of its common usage in solidification process and its relatively low Prandtl number ($Pr = 0.02$).

Derived from text

Crystal Growth; Cavities; Microgravity; Working Fluids; Vibration; Space Processing; Space Laboratories; Melts (Crystal Growth); Interfacial Tension

77

THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics. For related information see also 25 Inorganic and Physical Chemistry and 34 Fluid Mechanics and Heat Transfer.

19960024104; 96N26675 Joint Inst. for Nuclear Research, Dubna, USSR

Minimization of the scalar Higgs potential in the finite supersymmetric grand unified theory

Kodrashuk, I. N., Joint Inst. for Nuclear Research, USSR; 1995, pp. 26; In English

Report No.(s): JINR-E-2-95-63; DE96-608849; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

Exact mathematical solution of the minimization conditions of the scalar Higgs potential of the Finite Supersymmetric Grand Unification Theory is proposed and extremal field configurations are found. Types of extrema are investigated and masses of the new Higgs particles arisen after electroweak symmetry breaking are derived analytically. The conditions for existing of physically acceptable minimum are given. As it appears, this minimum is a simple generalization of the analogous solution in the Minimal Supersymmetric Standard Model. Phenomenological consequences are discussed briefly.

DOE

Electroweak Interactions (Field Theory); Grand Unified Theory; Scalars; Broken Symmetry

19960024169; 96N26728 Stanford Linear Accelerator Center, Stanford, CA USA

Light-cone quantization and QCD phenomenology

Brodsky, Stanley J., Stanford Linear Accelerator Center, USA; Robertson, David G., Ohio State Univ., USA; 1995, pp. 29; In English; ELFE Summer School and Workshop on Confinement Physics, 22-28 Jul. 1995, Cambridge, UK

Contract(s)/Grant(s): DE-AC03-76SF-00515; NSF PHY-92-03145; NSF PHY-92-58270; NSF PHY-92-07889
Report No.(s): SLAC-PUB-95-7056; CONF-9507212-1;

DE96-004692; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In principle, quantum chromodynamics provides a fundamental description of hadronic and nuclear structure and dynamics in terms of their elementary quark and gluon degrees of freedom. In practice, the direct application of QCD to reactions involving the structure of hadrons is extremely complex because of the interplay of nonperturbative effects such as color confinement and multi-quark coherence. A crucial tool in analyzing such phenomena is the use of relativistic light-cone quantum mechanics and Fock state methods to provide tractable and consistent treatments of relativistic many-body systems. In this article we present an overview of this formalism applied to QCD, focusing in particular on applications to the final states in deep inelastic lepton scattering that will be relevant for the proposed European Laboratory for Electrons (ELFE), HERMES, HERA, SLAC, and CEBAF. We begin with a brief introduction to light-cone field theory, stressing how it may allow the derivation of a constituent picture, analogous to the constituent quark model, from QCD. We then discuss several applications of the light-cone Fock state formalism to QCD phenomenology. The Fock state representation includes all quantum fluctuations of the hadron wavefunction, including far off-shell configurations such as intrinsic charm and, in the case of nuclei, hidden color. In some applications, such as exclusive processes at large momentum transfer, one can make first-principle predictions using factorization theorems which separate the hard perturbative dynamics from the nonperturbative physics associated with hadron binding. The Fock state components of the hadron with small transverse size, which dominate hard exclusive reactions, have small color dipole moments and thus diminished hadronic interactions. Thus QCD predicts minimal absorptive corrections, i.e., color transparency for quasi-elastic exclusive reactions in nuclear targets at large momentum transfer.

DOE

Quantum Chromodynamics; Quantum Mechanics; Quark Models; Color; Inelastic Scattering; Light-Cone Expansion; Nuclear Structure; Phenomenology

19960024191; 96N26742 Oak Ridge National Lab., Solid State Div., TN USA

Vibrational and electronic transition in INAS quantum dots formed by sequential implantation of In and As in a-SiO₂

Ueda, A., Fisk Univ., USA; Henderson, D. O., Fisk Univ., USA; Mu, R., Fisk Univ., USA; Tung, Y. S., Fisk Univ., USA; Hall, C., Fisk Univ., USA; Zhu, J. G., Oak Ridge National Lab., USA; White, C. W., Oak Ridge National Lab., USA; Zuhre, R. A., Oak Ridge National Lab., USA; Jan. 1996, pp. 6; In English; Fall Meeting of the Materials Research Society (MRS), 27 Nov. - 1 Dec. 1995, Boston, MA, USA

Contract(s)/Grant(s): DE-FG05-94ER-45521; DE-AC05-84OR-21400

Report No.(s): CONF-951155-89; DE96-006716; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

Optical, structural, and thermodynamic properties of materials can be changed by reducing their dimensions. We sequentially implanted In and As into fused silica windows in order to investigate formation and properties of InAs nanoparticles. UV/VIS/NIR, FTIR in mid-IR, and far-IR spectroscopy were used to study change in electronic transitions and in vibrational modes (phonons) of the nano-particles InAs. The phonons can be confined to the surface of nano-particles and have frequencies falling between the transverse and longitudinal optical modes of the bulk material. Thermal annealing developed the formation of InAs quantum dots from as-implanted In-As system. At certain annealing temperature a change in UV/VIS transmission spectra and IR reflectance spectra indicated formation of InAs quantum dots. This is particularly evident from the absorption in IR and surface phonon bands are observed, confirming presence of quantum confined InAs.

DOE

Vibrational States; Indium Arsenides; Phonons; Vibrational Spectra; Spectroscopic Analysis

19960024778; 96N26940 California Univ., Chemical Sciences Div., Berkeley. Lawrence Berkeley Lab, CA USA

Thermodynamics for separation-process technology

Prausnitz, J. M., California Univ., USA; Oct. 1995, pp. 43; In English; Conference on Separations, 22 Jul. 1995, Snowbird, UT, USA

Contract(s)/Grant(s): DE-AC03-76SF-00098

Report No.(s): LBL-37869; CONF-9507215-1; DE96-004721; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

When contemplating or designing a separation process, every chemical engineer at once recognizes the thermodynamic boundary conditions that must be satisfied: when a mixture is continuously processed to yield at least partially purified products, energy and mass must be conserved and work must be done. In his daily tasks, a chemical engineer uses thermodynamic concepts as tacit, almost subconscious, knowledge. Thus, qualitative thermodynamics significantly informs process conception at its most fundamental level. However, quantitative design requires detailed knowledge of thermodynamic relations and physical chemistry. Most process engineers, concerned with flow sheets and economics, cannot easily command that detailed knowledge and therefore it is advantageous for them to maintain close contact with those specialists who do. Quantitative chemical thermodynamics provides an opportunity to evaluate possible separation processes not only because it may give support to the process engineer's bold imagination but also because, when

coupled with molecular models, it can significantly reduce the experimental effort required to determine an optimum choice of process alternatives. Six examples are presented to indicate the application of thermodynamics for conventional and possible future separation processes.

DOE

Thermochemistry; Chemical Fractionation; Chemical Engineering

19960024994; 96N27119 Salerno Univ., Dipt. di Fisica., Italy

Operational Approach to Generalized Coherent States

DeMartino, Salvatore, Salerno Univ., Italy; DeSiena, Silvio, Salerno Univ., Italy; Fourth InterNational Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 29-34; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

Generalized coherent states for general potentials, constructed through a controlling mechanism, can also be obtained applying on a reference state suitable operators. An explicit example is supplied.

Author

Coherent Electromagnetic Radiation; Squeezed States (Quantum Theory); Quantum Mechanics

19960024996; 96N27121 Dezhou Teacher's Coll., Shandong, China

Antibunching Effect of Kappa-Component Q-Coherent States

He, Jinyu, Dezhou Teacher's Coll., China; Wang, Jisuo, Liaocheng Teacher's Coll., China; Wang, Chuankui, Liaocheng Teacher's Coll., China; Fourth InterNational Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 41-44; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A01, Hardcopy; A06, Microfiche

We introduce the antibunching effect for the q-electromagnetic field, and study this kind nonclassical properties of k-component q-coherent states given by Kuang et al. The results show that all of them show antibunching effect.

Author

Coherent Electromagnetic Radiation; Quantum Mechanics; Squeezed States (Quantum Theory); Electron Bunching

19960024997; 96N27122 Budapest Science Univ., Research Lab. for Crystal Physics., Hungary

Quantum State Engineering Via Coherent-State Superpositions

Janszky, Jozsef, Budapest Science Univ., Hungary; Adam, P., Budapest Science Univ., Hungary; Szabo, S., Budapest Science Univ., Hungary; Domokos, P., Budapest Science Univ., Hungary; Fourth InterNational Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 45-50; In English; Also announced as 1996038021

Contract(s)/Grant(s): OTKA-T14083; OTKA-F17380; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

The quantum interference between the two parts of the optical Schrodinger-cat state makes possible to construct a wide class of quantum states via discrete superpositions of coherent states. Even a small number of coherent states can approximate the given quantum states at a high accuracy when the distance between the coherent states is optimized, e. g. nearly perfect Fock state can be constructed by discrete superpositions of $n + 1$ coherent states lying in the vicinity of the vacuum state.

Author

Coherent Electromagnetic Radiation; Quantum Mechanics; Electromagnetic Fields

19960024999; 96N27124 Tianjin Univ., Dept. of Physics., China

Higher-Order Squeezing of Quantum Field and the Generalized Uncertainty Relations in Non-Degenerate Four-Wave Mixing

Li, Xi-Zeng, Tianjin Univ., China; Su, Bao-Xia, Tianjin Univ., China; Fourth InterNational Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 61-66; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

It is found that the field of the combined mode of the probe wave and the phase-conjugate wave in the process of non-degenerate four-wave mixing exhibits higher-order squeezing to all even orders. and the generalized uncertainty relations in this process are also presented.

Author

Four-Wave Mixing; Conjugates; Squeezed States (Quantum Theory); Quantum Optics

19960025000; 96N27125 Harbin Coll., Dept. of Physics., Harbin, China

The Squeezing Operator and the Squeezing States of Superspace

Aiqun, Ma, Harbin Coll., China; Changzhi, Yan, Harbin Inst. of Electrical Technology, China; Qiquang, Lu, Harbin Teacher's Coll., China; Weichun, Shi, Northeast Forestry Univ., China; Fourth InterNational Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 67-72; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

In this paper ,the unitary squeezing operator of 'superspace' is introduced and by making this operator act on the supercoherent state, the squeezing supercoherent states are obtained, then come out the four orthonormalization eigensates of the square of annihilation operator A of the supersymmetry harmonic oscillator, and their squeezing character is also studied.

Author

Squeezed States (Quantum Theory); Quantum Optics; Coherent Electromagnetic Radiation; Harmonic Oscillators

19960025001; 96N27126 Max-Planck-Gesellschaft, Arbeitsgruppe Nichtklassische Strahlung., Berlin, Germany

The Total Gaussian Class of Quasiprobabilities and its Relation to Squeezed-State Excitations

Wuensche, Alfred, Max-Planck-Gesellschaft, Germany; Fourth InterNational Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 73-82; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

The class of quasiprobabilities obtainable from the Wigner quasiprobability by convolutions with the general class of Gaussian functions is investigated. It can be described by a three-dimensional, in general, complex vector parameter with the property of additivity when composing convolutions. The diagonal representation of this class of quasiprobabilities is connected with a generalization of the displaced Fock states in direction of squeezing. The subclass with real vector parameter is considered more in detail. It is related to the most important kinds of boson operator ordering. The properties of a specific set of discrete excitations of squeezed coherent states are given.

Author

Squeezed States (Quantum Theory); Normal Density Functions; Coherent Electromagnetic Radiation

19960025003; 96N27128 Toyama Univ., Dept. of Physics., Japan

Generalization of the Time-Energy Uncertainty Relation of Anandan-Aharonov Type

Hirayama, Minoru, Toyama Univ., Japan; Hamada, Takeshi, Kanazawa Univ., Japan; Chen, Jin, Toyama Univ., Japan; Fourth InterNational Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 89-94; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

A new type of time-energy uncertainty relation was proposed recently by Anandan and Aharonov. Their formula, to estimate the lower bound of time-integral of the energy-fluctuation in a quantum state is generalized to the one involving a set of quantum states. This is achieved by obtaining an explicit formula for the distance between two finitely separated points in the Grassman manifold.

Author

Time Dependence; Quantum Mechanics; Manifolds (Mathematics)

19960025008; 96N27133 Instituto Politecnico Nacional, Dept. de Fisica., Mexico City, Mexico

Classical Trajectories and Quantum Spectra

Mielnik, Bogdan, Instituto Politecnico Nacional, Mexico; Reyes, Marco A., Instituto Politecnico Nacional, Mexico;

Fourth InterNational Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 123-131; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

A classical model of the Schrodinger's wave packet is considered. The problem of finding the energy levels corresponds to a classical manipulation game. It leads to an approximate but non-perturbative method of finding the eigenvalues, exploring the bifurcations of classical trajectories. The role of squeezing turns out decisive in the generation of the discrete spectra.

Author

Quantum Optics; Wave Packets; Energy Levels; Schrodinger Equation; Classical Mechanics

19960025009; 96N27134 Waseda Univ., Dept. of Physics., Tokyo, Japan

Quantum Zeno Effect in the Measurement Problem

Namiki, Mikio, Waseda Univ., Japan; Pasaczio, Saverio, Bari Univ., Italy; Fourth InterNational Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 133-138; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

Critically analyzing the so-called quantum Zeno effect in the measurement problem, we show that observation of this effect does not necessarily mean experimental evidence for the naive notion of wave-function collapse by measurement (the simple projection rule). We also examine what kind of limitation the uncertainty relation and others impose on the observation of the quantum Zeno effect.

Author

Collapse; Wave Functions; Quantum Mechanics

19960025011; 96N27136 Maryland Univ. Baltimore County, Dept. of Physics., Catonsville, MD USA

Quantum Mechanics of a Two Photon State

Rubin, Morton H., Maryland Univ. Baltimore County, USA; Fourth InterNational Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 145-150; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

We review the formalism for describing the two photon state produced in spontaneous parametric down conversion.

Author

Down-Converters; Quantum Mechanics; Quantum Optics; Photons; Phase Matching

19960025014; 96N27139 East China Normal Univ., Dept. of Physics., Shanghai, China

The Contradiction Between the Measurement Theory of Quantum Mechanics and the Theory that the Velocity of Any Particle Can Not be Larger than the Velocity of Light

Shen, Y., East China Normal Univ., China; Shen, Z. J., East China Normal Univ., China; Shen, G. T., East China Normal

Univ., China; Yang, B. C., East China Normal Univ., China; Fourth InterNational Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 165-168; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A01, Hardcopy; A06, Microfiche

By the measurement theory of quantum mechanics and the method of Fourier transform, we proved that the wave function $\psi(x,y,z,t) = (8/((2\pi)(2L(\exp(-1/2))))(\exp(3))(\Phi(L,t,x)\Phi(L,t,y)\Phi(L,t,z))$. According to the theory that the velocity of any particle can not be larger than the velocity of light and the Born interpretation, when absolute value of delta greater than $(ct+L)$, $\Phi(L,t,\delta) = 0$. But according to the calculation, we proved that for some delta, even if absolute value of delta is greater than $(ct+L)$, $\Phi(L,t,\delta)$ is not equal to 0.

Author

Quantum Mechanics; Wave Functions; Fourier Transformation; Velocity; Velocity Measurement

19960025018; 96N27143 Technion - Israel Inst. of Tech., Dept. of Physics., Haifa, Israel

Discrete Photodetection and Susskind-Glogower Phase Operators

Ben-Aryeh, Y., Technion - Israel Inst. of Tech., Israel; Fourth InterNational Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 203-207; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

State reduction processes in different types of photodetection experiments are described by using different kinds of ladder operators. A special model of discrete photodetection is developed by the use of superoperators which are based on the Susskind-Glogower raising and lower operators. The possibility to realize experimentally the discrete photodetection scheme in a micromaser is discussed.

Author

Photometers; Operators (Mathematics); Optical Measurement

19960025019; 96N27144 University of Science and Technology of China, Dept. of Physics., Hefei, China

A New Definition to the Phase Operator and its Properties

Duan, Lu-Ming, University of Science and Technology of China, China; Guo, Guang-Can, University of Science and Technology of China, China; Fourth InterNational Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 209-214; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

By introducing a series of mathematical symbols and the phase quantization condition, we give a new definition of the phase operator, which not only is made directly in infinite state spaces, but also circumvents all difficulties appearing in the traditional approach Properties of the phase operator and

its expressions in some widely-used representations are also given.

Author

Quantum Optics; Phase Coherence; Operators (Mathematics); Quantum Mechanics

19960025020; 96N27145 First Aeronautical Coll. of Air Force, Dept. of Foundation., Xinyang Henan, China

There aren't Non-Standard Solutions for the Braid Group Representations of the QYBE Associated with 10-D Representations of SU(4)

Yijun, Huang, First Aeronautical Coll. of Air Force, China; Guochen, Yu, First Aeronautical Coll. of Air Force, China; Hong, Sun, First Aeronautical Coll. of Air Force, China; Fourth InterNational Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 215-218; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A01, Hardcopy; A06, Microfiche

It is well known that the quantum Yang-Baxter equations (QYBE) play an important role in various theoretical and mathematical physics, such as completely integrable system in $(1 + 1)$ -dimensions, exactly solvable models in statistical mechanics, the quantum inverse scattering method and the conformal field theories in 2-dimensions. Recently, much remarkable progress has been made in constructing the solutions of the QYBE associated with the representations of lie algebras. It is shown that for some cases except the standard solutions, there also exist new solutions, but the others have not non-standard solutions. In this paper by employing the weight conservation and the diagrammatic techniques we show that the solution associated with the 10-D representations of SU (4) are standard alone.

Derived from text

Lie Groups; Statistical Mechanics; Group Theory; Quantum Mechanics

19960025021; 96N27146 First Aeronautical Coll. of Air Force, Dept. of Foundation., Xinyang Henan, China

Solutions of the Quantum Yang-Baxter Equations Associated with $(1-3/2)$ -D Representations of SU(sub q) (2)

Yijun, Huang, First Aeronautical Coll. of Air Force, China; Guochen, Yu, First Aeronautical Coll. of Air Force, China; Hong, Sun, First Aeronautical Coll. of Air Force, China; Fourth InterNational Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 219-222; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A01, Hardcopy; A06, Microfiche

The solutions of the spectral independent QYBE associated with $(1-3/2)$ -D representations of SU(sub q) (2) are derived, based on the weight conservation and extended Kauffman diagrammatic technique. It is found that there are nonstandard solutions.

Author

Lie Groups; Quantum Mechanics; Problem Solving

19960025023; 96N27148 Waseda Univ., Dept. of Physics., Tokyo, Japan

On the Stochastic Quantization Method: Characteristics and Applications to Singular Systems

Kanenaga, Masahiko, Waseda Univ., Japan; Namiki, Mikio, Waseda Univ., Japan; Fourth InterNational Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 229-234; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

Introducing the generalized Langevin equation, we extend the stochastic quantization method so as to deal with singular dynamical systems beyond the ordinary territory of quantum mechanics. We also show how the uncertainty relation is built up to the quantum mechanical limit with respect to fictitious time, irrespective of its initial value, within the framework of the usual stochastic quantization method.

Author

Quantum Mechanics; Langevin Formula; Stochastic Processes; Dynamical Systems

19960025026; 96N27151 Vietnam Physical Inst., Inst. of Physics., Hanoi, Viet Nam

The General Necessary Condition for the Validity of Dirac's Transition Perturbation Theory

Quang, Nguyen Vinh, Vietnam Physical Inst., Viet Nam; Fourth InterNational Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 253-258; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

For the first time, from the natural requirements for the successive approximation the general necessary condition of validity of the Dirac's method is explicitly established. It is proved that the conception of 'the transition probability per unit time' is not valid. The 'super-platinum rules' for calculating the transition probability are derived for the arbitrarily strong time-independent perturbation case.

Author

Perturbation Theory; Approximation; Dirac Equation; Transition Probabilities

19960025027; 96N27152 South China Construction Univ., Guangzhou, China

Nonclassical Properties of Q-Deformed Superposition Light Field State

Ren, Min, South China Construction Univ., China; Shenggui, Wang, Jiujiang Teacher's Coll., China; Ma, Aiqun, Harbin Coll., China; Jiang, Zhuohong, Heilongjiang Univ., China; Fourth InterNational Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 259-261; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A01, Hardcopy; A06, Microfiche

In this paper, the squeezing effect, the bunching effect and the anti-bunching effect of the superposition light field state which involving q-deformation vacuum state and

q-Glauber coherent state are studied, the controllable q-parameter of the squeezing effect, the bunching effect and the anti-bunching effect of q-deformed superposition light field state are obtained.

Author

Quantum Theory; Group Theory; Bunching; Squeezed States (Quantum Theory); Deformation

19960025028; 96N27153 First Aeronautical Coll. of Air Force, Dept. of Foundation, Xinyang Henan, China

Chiral Bosonization of Superconformal Ghosts

Shi, Deheng, First Aeronautical Coll. of Air Force, China; Shen, Yang, First Aeronautical Coll. of Air Force, China; Liu, Jinling, First Aeronautical Coll. of Air Force, China; Xiong, Yongjian, Xinyang Teacher's Coll., China; Fourth International Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 263-266; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A01, Hardcopy; A06, Microfiche

We explain the difference of the Hilbert space of the superconformal ghosts (beta,gamma) system from that of its bosonized fields phi and chi. We calculate the chiral correlation functions of phi, chi fields by inserting appropriate projectors.

Author

Hilbert Space; Correlation; Bosons

19960025032; 96N27157 Salerno Univ., Dipt. Di Fisica., Italy

Controlled Quantum Packets

DeMartino, Salvatore, Salerno Univ., Italy; DeSiena, Silvio, Salerno Univ., Italy; Fourth International Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 289-295; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

We look at time evolution of a physical system from the point of view of dynamical control theory. Normally we solve motion equation with a given external potential and we obtain time evolution. Standard examples are the trajectories in classical mechanics or the wave functions in Quantum Mechanics. In the control theory, we have the configurational variables of a physical system, we choose a velocity field and with a suited strategy we force the physical system to have a well defined evolution. The evolution of the system is the 'premium' that the controller receives if he has adopted the right strategy. The strategy is given by well suited laboratory devices. The control mechanisms are in many cases non linear; it is necessary, namely, a feedback mechanism to retain in time the selected evolution. Our aim is to introduce a scheme to obtain Quantum wave packets by control theory. The program is to choose the characteristics of a packet, that is, the equation of evolution for its centre and a controlled dis-

person, and to give a building scheme from some initial state (for example a solution of stationary Schroedinger equation). It seems natural in this view to use stochastic approach to Quantum Mechanics, that is, Stochastic Mechanics [S.M.]. It is a quantization scheme different from ordinary ones only formally. This approach introduces in quantum theory the whole mathematical apparatus of stochastic control theory. Stochastic Mechanics, in our view, is more intuitive when we want to study all the classical-like problems. We apply our scheme to build two classes of quantum packets both derived generalizing some properties of coherent states.

Derived from text

Classical Mechanics; Control Theory; Packets (Communication); Quantum Mechanics; Quantum Theory; Stochastic Processes; Wave Packets

19960025033; 96N27158 University of Science and Technology of China, Dept. of Physics., Hefei, China

A Secure Key Distribution System of Quantum Cryptography Based on the Coherent State

Guo, Guang-Can, University of Science and Technology of China, China; Zhang, Xiao-Yu, University of Science and Technology of China, China; Fourth International Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 297-300; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A01, Hardcopy; A06, Microfiche

The cryptographic communication has a lot of important applications, particularly in the magnificent prospects of private communication. As one knows, the security of cryptographic channel depends crucially on the secrecy of the key. The Vernam cipher is the only cipher system which has guaranteed security. In that system the key must be as long as the message and must be used only once. Quantum cryptography is a method whereby key secrecy can be guaranteed by a physical law. So it is impossible, even in principle, to eavesdrop on such channels. Quantum cryptography has been developed in recent years. Up to now, many schemes of quantum cryptography have been proposed. Now one of the main problems in this field is how to increase transmission distance. In order to use quantum nature of light, up to now proposed schemes all use very dim light pulses. The average photon number is about 0.1. Because of the loss of the optical fiber, it is difficult for the quantum cryptography based on one photon level or on dim light to realize quantum key-distribution over long distance. A quantum key distribution based on coherent state is introduced in this paper. Here we discuss the feasibility and security of this scheme.

Derived from text

Cryptography; Quantum Mechanics; Quantum Theory; Security; Scrambling (Communication); Communication

19960025034; 96N27159 Tsukuba Univ., Inst. of Physics., Ibaraki, Japan

Solvable Quantum Macroscopic Motions and Decoherence Mechanisms in Quantum Mechanics on Nonstandard Space

Kobayashi, Tsunehiro, Tsukuba Univ., Japan; Fourth International Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 301-306; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

Quantum macroscopic motions are investigated in the scheme consisting of N-number of harmonic oscillators in terms of ultra-power representations of nonstandard analysis. Decoherence is derived from the large internal degrees of freedom of macroscopic matters.

Author

Quantum Mechanics; Harmonic Oscillators

19960025035; 96N27160 Tamagawa Univ., Research Center for Quantum Communications., Tokyo, Japan

On a Relation Between Quantum Interference and Standard Quantum Limit

Momose, R., Tamagawa Univ., Japan; Osaki, M., Tamagawa Univ., Japan; Ban, M., Hitachi Ltd., Japan; Sasaki, M., Tamagawa Univ., Japan; Hirota, O., Tamagawa Univ., Japan; Fourth International Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 307-312; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

This paper discusses a physical meaning of the standard quantum limit (SQL) in quantum decision theory. It will be shown that a necessary condition for overcoming the SQL is quantum interference.

Author

Decision Theory; Quantum Theory

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Physical Meaning of the Optimum Measurement Process in Quantum Detection Theory

Osaki, Masao, Tamagawa Univ., Japan; Kozuka, Haruhisa, Tamagawa Univ., Japan; Hirota, Osamu, Tamagawa Univ., Japan; Fourth International Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 313-318; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

The optimum measurement processes are represented as the optimum detection operators in the quantum detection theory. The error probability by the optimum detection operators goes beyond the standard quantum limit automatically. However the optimum detection operators are given by pure mathematical descriptions. In order to realize a communication system overcoming the standard quantum limit, we try to

give the physical meaning of the optimum detection operators.

Author

Quantum Theory; Signal Detection; Error Analysis

19960025039; 96N27164 La Plata Univ., Dept. of Fisica., Argentina

Generalized Entropic Uncertainty Relations with Tsallis' Entropy

Portesi, M., La Plata Univ., Argentina; Plastino, A., La Plata Univ., Argentina; Fourth International Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 331-336; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

A generalization of the entropic formulation of the Uncertainty Principle of Quantum Mechanics is considered with the introduction of the q-entropies recently proposed by Tsallis. The concomitant generalized measure is illustrated for the case of phase and number operators in quantum optics. Interesting results are obtained when making use of q-entropies as the basis for constructing generalized entropic uncertainty measures.

Author

Quantum Mechanics; Entropy; Operators (Mathematics); Quantum Theory; Probability Distribution Functions

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Quantum Limits in Interferometric GW Antennas

Romano, R., Universita di Napoli Federico 2, Italy; Barone, F., Universita di Napoli Federico 2, Italy; Maddalena, P., Universita di Napoli Federico 2, Italy; Solimeno, S., Universita di Napoli Federico 2, Italy; Zaccaria, F., Universita di Napoli Federico 2, Italy; Manko, M. A., Lebedev Physical Inst., Russia; Manko, V. I., Lebedev Physical Inst., Russia; Fourth International Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 337-344; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

We discuss a model for interferometric GW antennas illuminated by a laser beam and a vacuum squeezed field. The sensitivity of the antenna will depend on the properties of the radiation entering the two ports and on the optical characteristics of the interferometer components, e.g. mirrors, beam-splitter, lenses.

Author

Michelson Interferometers; Photons; Laser Beams; Beam Splitters; Fourier Analysis; Noise Propagation; Squeezed States (Quantum Theory)

19960025041; 96N27166 Camerino Univ., Dipt. di Matematica e Fisica., Camerino, Italy

Continuous Feedback and Macroscopic Coherence

Tombesi, Paolo, Camerino Univ., Italy; Vitali, David,

Camerino Univ., Italy; Fourth InterNational Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 345-352; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

We show that a model, recently introduced for quantum nondemolition measurements of a quantum observable, can be adapted to obtain a measurement scheme which is able to slow down the destruction of macroscopic coherence due to the measurement apparatus.

Author

Kerr Effects; Feedback; Electro-Optical Effect; Cavities; Quantum Theory

19960025042; 96N27167 Instituto Politecnico Nacional, Dept. de Fisica., Mexico City, Mexico

Classical-Quantum Correspondence by Means of Probability Densities

Vegas, Gabino Torres, Instituto Politecnico Nacional, Mexico; Morales-Guzman, J. D., Instituto Politecnico Nacional, Mexico; Fourth InterNational Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 353-356; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A01, Hardcopy; A06, Microfiche

Within the frame of the recently introduced phase space representation of non relativistic quantum mechanics, we propose a Lagrangian from which the phase space Schrodinger equation can be derived. From that Lagrangian, the associated conservation equations, according to Noether's theorem, are obtained. This shows that one can analyze quantum systems completely in phase space as it is done in coordinate space, without additional complications.

Author

Lagrangian Function; Quantum Mechanics; Schroedinger Equation; Conservation Equations

19960025044; 96N27169 Northwestern Univ., Dept. of Electrical Engineering and Computer Science., Evanston, IL USA

High-Rate Strong-Signal Quantum Cryptography

Yuen, Horace P., Northwestern Univ., USA; Fourth InterNational Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 363-368; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

Several quantum cryptosystems utilizing different kinds of nonclassical lights, which can accommodate high intensity fields and high data rate, are described. However, they are all sensitive to loss and both the high rate and the strong-signal character rapidly disappear. A squeezed light homodyne detection scheme is proposed which, with present-day technology, leads to more than two orders of magnitude data rate improvement over other current experimental systems for moderate loss.

Author

Cryptography; Homodyne Reception; Optical Communication; Signal Transmission; Squeezed States (Quantum Theory)

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Quantum Probability Cancellation Due to a Single-Photon State

Ou, Z. Y., Indiana Univ.-Purdue Univ., USA; Fourth InterNational Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 479-487; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

When an N-photon state enters a lossless symmetric beamsplitter from one input port, the photon distribution for the two output ports has the form of Bernoulli Binomial, with highest probability at equal partition ($N/2$ at one output and $N/2$ at the other). However, injection of a single photon state at the other input port can dramatically change the photon distribution at the outputs, resulting in zero probability at equal partition. Such a strong deviation from classical particle theory stems from quantum probability amplitude cancellation. The effect persists even if the N-photon state is replaced by an arbitrary state of light. A special case is the coherent state which corresponds to homodyne detection of a single photon state and can lead to the measurement of the wave function of a single photon state.

Author

Quantum Theory; Probability Theory; Photons; Particle Theory

19960025061; 96N27186 East China Normal Univ., Lab. for Quantum Optics., Shanghai, China

Quantum Interference Effects in Molecular Y- and Rhomb-Type Systems

Xia, Hui-Rong, East China Normal Univ., China; Ye, Cen-Yun, East China Normal Univ., China; Xu, Jian-We, East China Normal Univ., China; Ding, Liang-En, East China Normal Univ., China; Fourth InterNational Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 501-505; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

In this paper we report the first observation of molecular population trapping in four level systems. Constructive and destructive quantum interferences between two sum-frequency two-photon transitions in Y- and rhomb-type four-level systems, respectively, in sodium molecules have been experimentally achieved by using only one laser source. Their energy level schemes are featured by the extremely near-resonant enhancement of the equal-frequency two-photon transitions, sharing both the initial and the intermediate levels for the Y-type, and sharing both the initial and the final levels for the rhomb-type systems. Their novel spectral effects are to show seriously restrained Doppler-free UV peak at the nomi-

nal location of the induced two-photon transition with visible fluorescence in rhomb-type schemes, and to show a strong extra UV peak but null visible fluorescence in the middle between the two dipole allowed two-photon transitions.

Author

Quantum Theory; Photons; Spectra; Frequency Assignment

19960025065; 96N27190 Xi'an Jiaotong Univ., Dept. of Physics., Korea, Republic of

The Amplitude Nth-Power Squeezing of Radiation Fields in the Degenerate Raman Process

Zhang, Zhi-Ming, Xi'an Jiaotong Univ., Korea, Republic of; Pan, Jin-Fang, Shanxi Normal Univ., China; Xu, Lei, Academia Sinica, China; Fourth InterNational Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 539-544; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

In this paper we study the amplitude Nth-power squeezing of radiation fields in the degenerate Raman process by using the modified effective Hamiltonian approach recently suggested by us. We found that if the field is initially in a coherent state it will not get squeezing for any Nth-power; if the field is initially in a squeezed vacuum, it may get Nth-power squeezing. The time evolution of the field fluctuation was discussed. Its dependences on power-order N, mean photon number \bar{n} , and squeezing angle ξ are analyzed.

Author

Hamiltonian Functions; Radiation Distribution; Raman Spectra

19960025070; 96N27195 Canberra Univ., Advanced Telecommunications Engineering Centre., Belconnen, Australia
Macroscopic Violation of Three Cauchy-Schwarz Inequalities Using Correlated Light Beams From an Infra-Red Emitting Semiconductor Diode Array

Edwards, P. J., Canberra Univ., Australia; Huang, X., Canberra Univ., Australia; Li, Y. Q., Editor, Arkansas Univ., USA; Wang, Y. Z., Editor, Shanghai Univ., China; Fourth InterNational Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 575-580; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

We briefly review quantum mechanical and semi-classical descriptions of experiments which demonstrate the macroscopic violation of the three Cauchy-Schwarz inequalities: $g^{(2)}(0) \geq 1$; $g^{(2)}(0) \geq g^{(2)}(t)$, (t approaches infinity); (the absolute value of $g^{(2)}(0)$) $\leq g^{(2)}(0) g^{(2)}(0)$. Our measurements demonstrate the violation, at macroscopic intensities, of each of these inequalities. We show that their violation, although weak, can be demonstrated through photodetector current covariance measurements on correlated sub-Poissonian Poissonian, and super Poissonian

light beams. Such beams are readily generated by a tandem array of infrared-emitting semiconductor junction diodes. Our measurements utilize an electrically coupled array of one or more infrared-emitting diodes, optically coupled to a detector array. The emitting array is operated in such a way as to generate highly correlated beams of variable photon Fano Factor. Because the measurements are made on time scales long compared with the first order coherence time and with detector areas large compared with the corresponding coherence areas, first order interference effects are negligible. The first and second inequalities are violated, as expected, when a sub-Poissonian light beam is split and the intensity fluctuations of the two split beams are measured by two photodetectors and subsequently cross-correlated. The third inequality is violated by bunched (as well as anti-bunched) beams of equal intensity provided the measured cross correlation coefficient exceeds $(F - 1)/F$, where F is the measured Fano Factor of each beam. We also investigate the violation for the case of unequal beams.

Author

Cauchy Problem; Semiconductor Junctions; Semiconductor Diodes; Photons; Junction Diodes; Correlation Coefficients

19960025071; 96N27196 Sichuan Univ., Dept. of Opto-Electronics Science and Technology., Chengdu, China

Photon Number-Phase Uncertainty Relation in the Evolution of the Field in a Kerr-Like Medium

Fan, An-Fu, Sichuan Univ., China; Sun, Nian-Chun, Southwest Inst. of Technical Physics, China; Fourth InterNational Conference on Squeezed States and Uncertainty Relations; Jan. 1996, pp. 581-586; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

A model of a single-mode field, initially prepared in a coherent state, coupled to a two-level atom surrounded by a nonlinear Kerr-like medium contained inside a very good quality cavity is considered. We derive the photon number-phase uncertainty relation in the evolution of the field for a weak and strong nonlinear coupling respectively, within the Hermitian phase operator formalism of Pegg and Barnett, and discuss the effects of nonlinear coupling of the Kerr-like medium on photon number-phase uncertainty relation of the field.

Author

Photons; Normal Density Functions

19960025078; 96N27203 Hebei Univ., Dept. of Physics., Baoding, China

Multiphoton Process and Anomalous Potential of Cell Membrane by Laser Radiation

Zhang, Kaixi, Hebei Univ., China; Zhao, Qingxun, Hebei Univ., China; Cui, Zhiyun, Hebei Univ., China; Zhar, Ping, Academia Sinica, China; Dong, Lifang, Academia Sinica, China; Fourth InterNational Conference on Squeezed States

and Uncertainty Relations; Jan. 1996, pp. 627-629; In English; Also announced as 1996038021; No Copyright; Avail: CASI; A01, Hardcopy; A06, Microfiche

In this paper, by the use of quantum biology and quantum optics, the laser induced potential variation of cell membrane has been studied. Theoretically, we have found a method of calculating the monophoton and multiphoton processes in the formation of the anomalous potential of cell membrane. In contrast with the experimental results, our numerical result is in the same order. Therefore, we have found the possibility of cancer caused by the laser induced anomalous cell potential.

Author

Laser Beams; Quantum Optics; Membranes

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On bosonization in 3 dimensions

Barci, D. G., Universidade Federal do Rio de Janeiro, Brazil; Oxman, L.E., Buenos Aires Univ., Argentina; Fosco, C. D., InterNational Centre for Theoretical Physics, Italy; Aug. 1995, pp. 15; In English

Report No.(s): IC-95/244; DE96-607040; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

A recently proposed path-integral bosonization scheme for massive fermions in 3 dimensions is extended by keeping the full momentum-dependence of the one-loop vacuum polarization tensor. This makes it possible to discuss both the massive and massless fermion cases on an equal footing, and moreover the results it yields for massless fermions are consistent with the ones of another, seemingly different, canonical quantization approach to the problem of bosonization for a massless fermionic field in 3 dimensions.

DOE

Theoretical Physics; Fermions; Boson Fields

19960025386; 96N27428 Argonne National Lab., IL USA
De Broglie wavelets versus Schroedinger wave functions: A ribbon model approach to quantum theory and the mechanisms of quantum interference

Tang, Jau, Argonne National Lab., USA; 1996, pp. 27; In English

Contract(s)/Grant(s): W-31109-ENG-38

Report No.(s): ANL/CHM/PP-86044; DE96-006658; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As an alternative to better physical explanations of the mechanisms of quantum interference and the origins of uncertainty broadening, a linear hopping model is proposed with "color-varying" dynamics to reflect fast exchange between time-reversed states. Intricate relations between this model, particle-wave dualism, and relativity are discussed. The wave function is shown to possess dual characteristics of a stable,

localized "soliton-like" de Broglie wavelet and a delocalized, interfering Schroedinger carrier wave function.

DOE

Quantum Theory; Wave Functions; Schroedinger Equation; De Broglie Wavelengths

19960025446; 96N27483 Auburn Univ., Dept. of Aerospace Engineering., AL USA

Thermodynamic measurements in a high pressure hydrogen-oxygen flame using Raman scattering from a broadband excimer laser

Hartfield, Roy, Jr., Auburn Univ., USA; Research Reports: 1995 NASA/ASEE Summer Faculty Fellowship Program; Feb. 1996, pp. 8; In English; Also announced as 1996043981; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Raman scattering is an inelastic molecular scattering process in which incident radiation is reemitted at a fixed change in frequency. Raman spectroscopy can be used to measure the number density and temperature of the irradiated species. The strength of the Raman signal is inversely proportional to the wavelength raised to the fourth power. Consequently, high signal to noise ratios are obtained by using ultraviolet (UV) excitation sources. Using UV sources for Raman Spectroscopy in flames is complicated by the fact that some of the primary constituents in hydrogen-oxygen combustion absorb and reemit light in the UV and these fluorescence processes interfere with the Raman signals. This problem has been handled in atmospheric pressure flames in some instances by using a narrowband tunable excimer laser as a source. This allows for detuning from absorption transitions and the elimination of interfering fluorescence signals at the Raman wavelengths. This approach works well in the atmospheric pressure flame; however, it has two important disadvantages. First, injection-locked narrowband tunable excimer lasers are very expensive. More importantly, however, is the fact that at the high pressures characteristic of rocket engine combustion chambers, the absorption transitions are broadened making it difficult to tune to a spectral location at which substantial absorption would not occur. The approach taken in this work is to separate the Raman signal from the fluorescence background by taking advantage of the fact that Raman signal has nonisotropic polarization characteristics while the fluorescence signals are unpolarized. Specifically, for scattering at right angles to the excitation beam path, the Raman signal is completely polarized. The Raman signal is separated from the fluorescence background by collecting both horizontally and vertically polarized signals separately. One of the polarizations has both the Raman signal and the fluorescence background while the other has only the fluorescence signal. The Raman scatter is the difference between the signals. by choosing an appropriate optical setup, both signals can be obtained

simultaneously with the same monochromator; hence, time resolved measurements are possible using this approach.

Derived from text

Hydrogen Oxygen Engines; Excimer Lasers; Combustion Chambers; Raman Spectra; Flames; NASA Programs; University Program; Polarization Characteristics; Fluorescence

19960025538; 96N27545 Lawrence Livermore National Lab., Livermore, CA USA

Stochastic models of chaotic systems

Leith, C. E., Lawrence Livermore National Lab., USA; Sep. 1995, pp. 26; In English; Nonlinear Phenomena In Ocean Dynamics, 15-19 May 1995, Los Alamos, NM, USA

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): UCRL-JC-122213; CONF-9505328-1; DE96-007545; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Nonlinear dynamical systems, although strictly deterministic, often exhibit chaotic behavior which appears to be random. The determination of the probabilistic properties of such systems is, in general, an open problem. Closure approximations for moment expansion methods have been unsatisfactory. More successful has been approximation on the dynamics level by the use of linear stochastic models that attempt to generate the probabilistic properties of the original nonlinear chaotic system as closely as possible. Examples are reviewed of this approach to simple nonlinear systems, to turbulence, and to large-eddy simulation. A stochastic model that simulates the transient energy spectrum of the global atmosphere is developed.

DOE

Climate Models; Computerized Simulation; Nonlinear Systems; Mathematical Models; Turbulence; Stochastic Processes; Dynamical Systems